DECLARATION

I, the undersigned, hereby declare that this thesis has been composed by myself, and that it is my own work.

HEALTH AND ILL-HEALTH IN A COALMINING COMMUNITY IN WEST FIFE

by

IAN GEORGE JONES

A thesis for the degree of Doctor of Medicine of the University of Edinburgh, September 1978.

FOREWORD

This work is based on research conducted during my attachment to Fife Area Health Board as a Fellow in Community Medicine. I am grateful to the Board's staff, in particular its Chief Administrative Medical Officer, Dr. J.C.G. Mercer, and to my employers, the Scottish Council for Postgraduate Medical Education for all their support.

Many individuals and organisations contributed to this study. The staff of the Primary Care Division, Fife Area Health Board, of the National Health Service Central Registry, Edinburgh, and at Register House, Edinburgh, willingly searched their records for essential data on my behalf. Mr. Ray Harris organised the photography of my maps and figures. Miss Wilma Watson produced a first-class typescript from difficult, hand-written, copy. Miss Fadwa Affara reviewed my manuscript and argued its points with me. Dr. Donald Cameron, my tutor, gave me invaluable advice, encouragement and criticism at every stage of the study. To all of them I am deeply indebted.

Others have contributed in indirect, though no less essential ways. My wife and family tolerated my obsession throughout. Dr. Mark Lowenthal gave me encouragement and example well before this project was even contemplated. To them I also express my thanks.

Most of all, however, I wish to express my thanks to Mr. Jim Hunter and his fellow miners from the Nellie Pit, Lochgelly, without whose interest, enthusiasm and co-operation this study could not have been done. To him and his colleagues I dedicate this work.

CONTENTS

LIST OF TABLES

15/

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

A working model of the WHO definition of health was developed which involved dialogue with health workers and members of the community.

The method developed was applied to the investigation of the health and health care of a mining community in West Fife.

In general, health care facilities were found to be less than adequate to cope with presend demand and co-operation between certain services was poor.

A cohort of 427 men who had all worked at one coalmine in West Fife in 1955 was traced in 1977. By combining information from standard NHS sources with that supplied by survivors still living in Fife, it was possible to ascertain the vital status of all the cohort, and to confirm this in 97%.

Cohort mortality was investigated using actuarial methods and in general did not differ from that of other men in Britain of the same age. Some differences were found in cause-specific mortality and difficulties in interpreting these data are discussed.

A stratified simple random sample of men still resident in West Fife was investigated by interview and, where appropriate, by examination of their hospital records and discussion with their GPs. The response rate to the questionnaire was 100%. The/...

The men were found to have high levels of ill-health. Difficulties they encountered with the local health services are discussed.

All teenage recruits into the cohort in the early 1950s who were still living in Fife were similarly interviewed and the replies supplemented by information from GPs and hospital records. The response rate to the questionnaires was 100%. All these men had been face-workers at some time although less than half were still employed in the coalmining industry at the time of interview. The men were found to have very high levels of acute and chronic ill-health and 14% were confirmed to have severe disability as a direct consequence of their work in the mines. The prevalence of ill-health was much higher than among other men in Scotland and this difference could not be explained on the basis of selective migration of healthy men away from the area.

"On the day that ye mairry a collier chiel
a gey wee poke'll haud yer meal.
Ye micht as weel gang tae the diel
as mairry a dirty collier."

Walter Perrie (1977)

(A Lamentation for the Children)

1. Introduction.

1.1. The Nature of Community Medicine

This thesis is a contribution to the debate on the specialty of community medicine which has been called for and conducted in the medical press over the last few years (Stone, 1976). I join the debate to offer an example of what I believe community medicine's contribution to our society can be.

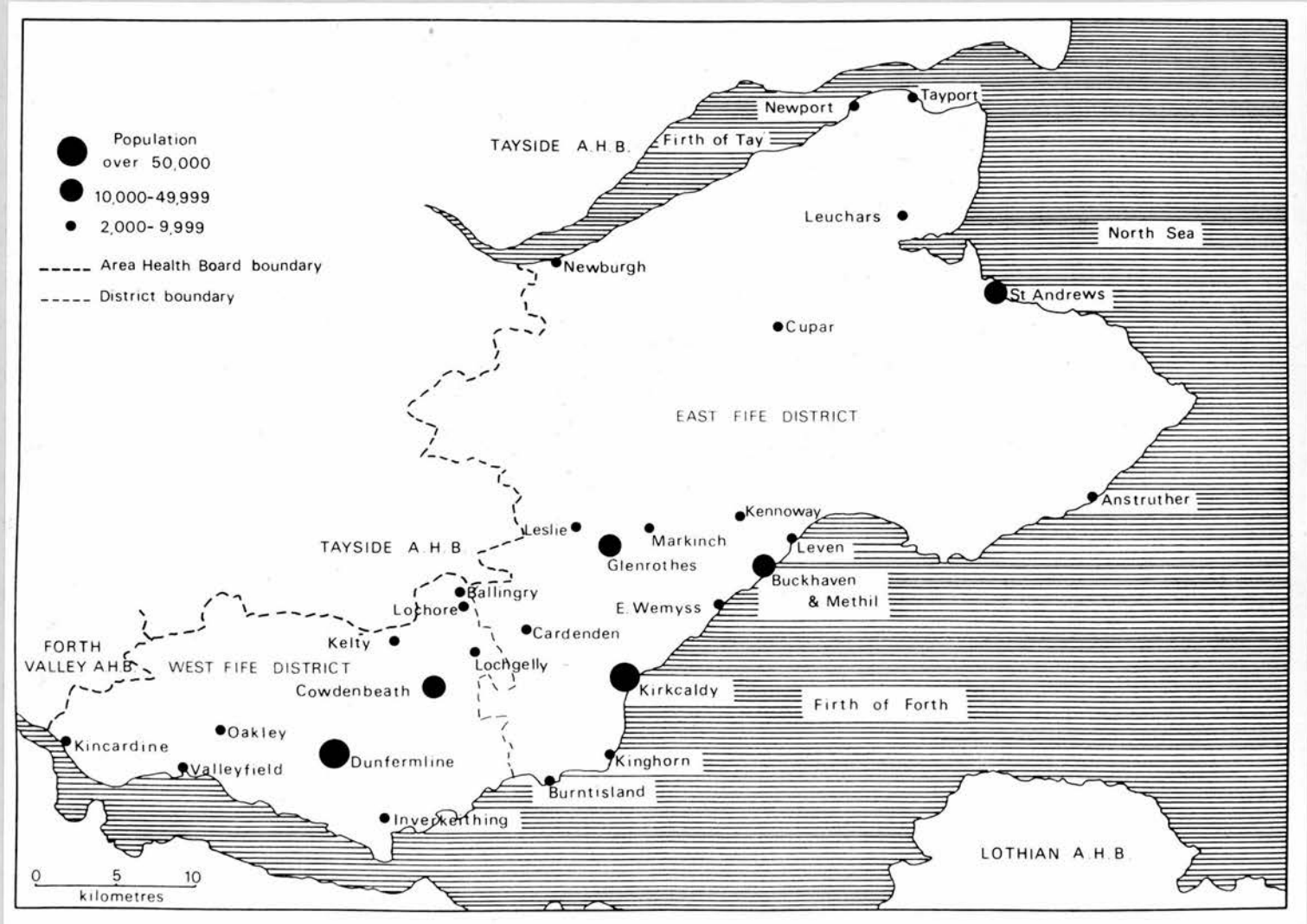
When the Joint Working Party appointed by the Secretary of State for Scotland stated that "Put at its simplest, community medicine is concerned with the study of health and disease in populations" (S.H.H.D. 1971), it distorted the role of community medicine by oversimplification. Perhaps epidemiology may be described as the study of health and disease in populations, but it, in company with statistics, social policy, social sciences and management, is merely one of the tools of the trade of community medicine (Cameron, 1976). Practitioners of community medicine are no more students of health and disease in populations than are physicians students of health and disease in individual patients. Both in fact are more than simply students; they are activists concerned with the promotion of health, the one in the individual, the other in the whole population. All populations comprise individuals and community medicine in concerning itself with populations is concerned with the practical problems of all the individuals who make up these populations. Community/

Community medicine distinguishes itself from clinical medicine not by any lack of interest in individual patients or their problems but by an interest in the individual problems of every member of the community, not simply those who have come into contact with the health services. Nor is the community medicine specialist confined like his clinical counterpart within the administrative boundaries of the National Health Service. He is free to investigate and comment on every aspect of society which has a bearing on the health of the community: indeed it is his duty to do so.

Practitioners of community medicine do indeed study health and disease in populations, but in emphasising that aspect of their work at the expense of the practical problems of the individuals who make up these populations, one is in danger of being led to the abstracted empiricism that has plagued community medicine and epidemiological research in recent years. C. Wright Mills (1959) has exposed abstracted empiricism in a characteristically poignant manner as a "pretentious over-elaboration of method" resulting from a "lack of firm connexion with substantive problems", and has summed it up as an "abdication of classic social science". Examples of this form of "methodological inhibition" can be found in most issues of community medicine journals: the recent sterile debate in one prominent journal on the correlation between a person's month of birth and his or her month of death is but one glaring example of this form of empty ingenuity. Even in theoretical discussions it is the epistomology of method that appears to dominate contributions to the philosophy of community medicine (Buck, 1975).

My hope is that this thesis will be seen as a further example of the scope for community medicine in the tackling of practical problems using a combination of theoretical understanding and empirical observations. Certainly my attachment to Fife Area Health Board (Figure 1) from July, 1976 to 1978 as a Fellow in Community Medicine has offered me a unique opportunity to undertake this task.

Figure 1: Map of Fife Area Health Board.



1.2. The Basic Research Problem

My basic research problem was to evaluate the health status of the people of Fife, to ascertain what the health services in Fife are doing to improve their health or alleviate the effects of any ill-health, and to determine the extent to which these activities are relevant to their needs and wants. Such a colossal undertaking however was well beyond my capabilities, limited as I was by the absence, in the way of personnel, hardware and adequate financial backing, of virtually any assistance in the completion of this task. With these constraints I needed to be selective both in the size of the population to be investigated and in the depth of my enquiry.

For several reasons a research project into the health status of a Fife coalmining community appeared an attractive possibility. Firstly, there has been a long and continuous association between coalmining and Fife since at least 1291 when the abbot and monks at Dunfermline Abbey were granted a charter to dig coal on the estate of the Lord of Pittencrieff, William de Oberwill. Secondly, coalmining is of great current importance to the people of Fife; the National Coal Board (NCB) is the largest simple industrial employer in Scotland and the Fife coalfields make a major contribution to its work and employ over 6% of the Fife labour force. Thirdly, this industry is associated with particular health hazards which have been studied and documented, albeit in a somewhat empiricist fashion, over many years.

Fourthly/

Fourthly, from a sociological standpoint coalmining is unique in that it is one of the last remaining all-male occupations, frequently employing successive generations of the same mining families, and one in which, even to this day in Fife, its workers live to a large extent in communities separated from other industrial workers. Bearing in mind the totality of these conditions in which miners work and live, the overall impact of the industry on their health, health provisions, and health needs seemed to merit further consideration.

No view of the health implications of coalmining could be in any way comprehensive if it merely documented the health status of the miners or the community in an empiricist fashion. The point of course is to determine and comment on the adequacy of our efforts to improve their health. Many agencies exist which provide health services to the community, including the National Health Service, Government, Regional and District Council departments, private industry, the Health and Safety Commission, the River Boards, and numerous voluntary bodies. The activities of all these agencies, the degree to which the health of the community is raised by the complementary aspects of their work and by their degree of mutual cooperation are clearly fruitful grounds for the community medicine specialist to investigate.

1.3. <u>The Origin of the Group of Coalworkers Selected for Study</u>

Having determined the potential suitability of workers as a group to study, the next step involved making contact with working miners in Fife to discuss the research proposal with them and enlist their help. At/

At our first such meeting in October, 1976, twelve of us participated in a wide-ranging discussion both about the general health implications of coalmining and about the project. Prior to this initial encounter I had tentatively considered that the small area around Valleyfield and Oakley in West Fife would be suitable to study. The miners, however, while expressing great interest in the study, felt that a more appropriate community existed in the area of central Fife around Cowdenbeath and Lochgelly, and presented several cogently argued points to support their case: the long history of coalmining in this area, the need to include retired and former coalworkers, many of whom resided in central Fife, in order to obtain a realistic assessment of the health implications of mining, and the likelihood of better cooperation were all raised.

After reaching agreement on central Fife as a study area the next problem discussed was the population to be investigated. Because morbidity is obviously higher among men who are no longer working miners, the inappropriateness of such a sampling frame was emphasised, and it was thought that the only population which would give a picture in any way representative of the overall health implications of coalmining would be one which included present, former, retired and deceased coalworkers. From this a cohort study emerged as the most feasible, although the obvious drawbacks were also noted: the problem of obtaining the names of such a cohort, of tracing the survivors and of obtaining details on the cause of death of the deceased; the impossibility of obtaining occupational histories other than on survivors; the widely different age distribution and occupational histories of the cohort. However/

However on balance it was felt that such interesting possibilities were raised by the prospect of handling and interpreting the complex survival data of such a cohort that its very heterogeneity was a factor in its favour and that this outweighed consideration of the magnitude of the task in actually following up the group.

The men then pointed out that although every working miner must be a member of the National Union of Mineworkers (NUM), the Union itself did not keep records of current or ex-members. These they thought could be most readily obtained from the NCB, and suggested that as a first step the Board be approached with a request to supply the names, dates of birth and last known addresses of all the employees. of one of the many central Fife pits employing around 200 men which closed down some 15 to 20 years ago. For reasons known only to itself the NCB regrettably refused to cooperate in this venture.

The next step was an approach to the NUM Scottish Headquarters where their late Secretary re-emphasised the fact that they did not keep records of current or former members, but he was able to suggest a retired miner and former union official who might be able to help. As it turned out this former official willingly provided me with a list he had kept of around 400 names, with dates of birth, of workers at the Nellie Pit, Lochgelly, drawn up in 1955 some 11 years before it closed down. It is the health of this cohort which forms the basis of this thesis.

1.4. Some Research Questions /

1.4. Some Research Questions

(i) Fundamental problems in the evaluation of the health status of an individual or community lie in defining both what we mean by the term "health" and how we intend to measure it, bearing in mind of course that a thorough understanding of a subject is not always a prerequisite to measuring it. However the word "health" has been given so many different meanings and taken on such varied significance depending on who has used it and under what circumstances that consideration of the implications of the use of the word is necessary by any researcher in this field. What then is the meaning of "health" to a worker in community medicine and how can it be measured?

(ii) A follow-up study of a cohort of men, about whom only names and dates of birth were recorded at the time they worked together over twenty years ago in a coalmine which has now been closed down for some twelve years, presents considerable epidemiological problems, especially since many men will have moved away from the area, many will have died, and no single register exists which documents the movements and deaths of such a group. Is it possible, using only the limited resources available to one researcher to trace this cohort of men? What new techniques, if any, are required to accomplish this?

(iii) Partly as a result of migration into and out of the industry many people have an erroneous impression of the health implications of coalmining, a fact that has been widely commented on in the past. Over the last twenty years the National Coal Board has closed down many Fife pits, making men redundant, moving them to other pits, or retiring them because of ill-health. Besides/

Besides these actions of the Board many miners have left the industry for personal reasons, perhaps for better wages, more congenial working conditions, or because they had begun to feel that, although they had no specific illness, work in the mines was beginning to take its toll of health and energy. In the case of miners who remain in the industry until retirement or death health and longevity are well documented here in the U.K. However the health of all the men working and who have worked in the pits is something we know less about. Many who have already suffered damage to their health will have left for some other job, and ill-health, and especially death, will be attributed in the statistics to their second industry. What then is the current health status of a cohort of coalworkers all of whom worked in the 1950's at the same time in the same Fife coalmine? What agencies provide health services for this cohort? Do these agencies take cognisance of the special nature of the coalmining industry in the delivery of health care to this group?

2. The Definition of Health.

In this chapter the problem of defining health satisfactorily is discussed and some of the literature on the subject is reviewed. A model of health applicable to workers in the field of community medicine is developed and the task of making it operational is explored in the context of some of the difficulties met by others researching this area.

2.1. The Need for Conceptual and Operational Definitions

It is generally agreed that our present system of health care is largely based not on the concept of health but of disease. With this approach health is conceived of, only with difficulty, in terms other than the mere absence of disease. Consequently, our orientation tends to be directed to the curing of disease rather than the promotion of health. This negative attitude to health is not only nurtured throughout medical school, but is also the major philosophy underlying the basic training schemes given to all health workers (Cardus, 1973; Mahler, 1977; Wylie, 1970). Increasingly however both health workers and members of the public, in their realisation that such a negative approach is inadequate to meet present health needs, are becoming more orientated towards a positive concept of health. Clearly, if the health care services are to be able to follow this new direction in health care thinking, it becomes incumbent upon them to define health in positive and workable terms. Some have argued that it may be undesirable to define health, not merely because no adequate definition is possible but because they feel that strict definitions militate against further thinking in this field.

I/

I would suggest that these contentions are arguments against poor, inadequate definitions and should not persuade the medical profession to abandon its task of arriving at a definition of health appropriate for today's society.

While conceding that a conceptual definition of health may be helpful Cardus (1973) nevertheless felt that it would be of doubtful use. In promulgating this notion Cardus underestimates the degree to which the conceptual and operational definitions are linked. To aid clarification of our goals, to assist in the realignment from disease towards our new goal of health, we must, by indicating our boundaries and limits, conceptualise health as the first step towards its measurement; the operational definition may then follow to indicate more precise positions on our scale (Wylie, 1970). That it may not, however, be necessary to define health as a precondition to measurement has been raised using the analogy of the natural sciences that the lack of a satisfactory definition of "time" has not hindered its measurement (Cardus & Thrall, 1977). This is a spurious notion in that arguments about defining "time" are conducted among theoretical physicists with the rest of us unperturbed by the debate because we know what we mean when we use the term. This is not the case with "health" as its conceptualisation is of importance to all health workers, to the community and even more importantly to enable dialogue between the two.

2.2. The Evolution of the Concept of Health /

2.2. The Evolution of the Concept of Health

There is no doubt that the idea of health has been of great interest to Man since earliest times. Plato in ancient Greece defined health as the regular order of the body, and throughout the ages philosophers, doctors and others have attempted to clarify and redefine the term. In an etymological and semantic account of health, Dolfam (1973) noted that around 1000 A.D. when the word first appeared in our language it implied a soundness or wholeness of the body and that this paradigm has had general acceptance since that period. In the middle ages this idea developed to include spiritual, moral and mental aspects. Variation of meaning dating from Shakespearean times has added the concept of well-being and prosperity, a notion still echoed when we toast each other's health.

Most commentators agree that a marked qualitative change in these very broad ideas of health occurred when we moved from the middle ages into the modern era. The model since developed has been labelled "universal-mechanistic" by Kelman (1975), universal in the sense that it implied a belief that health is independent of the existing form of society and hence universally applicable. Furthermore he claims it arose out of the transition from a religious to a scientific concept of health and disease. This machine model of the human body had its origins in the developments of analytic science some five centuries ago when the scientific discoveries and inventions of the day, coupled with the Church's approval to dissect and study the human body, began to have an impact on medical science (Engel, 1977). Engel/

Engel feels that this scientific approach was confined to examination of the human body and did not include examination of the mind or of human behaviour because, in the Church's view, the latter were more closely connected "with religion and the soul and hence properly remained its domain". Health then came to be regarded as the perfect functioning of the human body, a self-propelling machine or automaton (Kelman, 1975), with the role of the doctor being that of the mechanic called in when the human machine broke down to effect a repair. The biomedical or bio-individualist model formulated by medical scientists for the study and explanation of disease (Sheldon, 1974), was but a short step from this stage, and it is this model which forms the basis for the most fashionable modern paradigm of health, namely that of a disease-free state or condition.

2.2. 1. Health as a Disease-Free State or Condition

It has been noted by Kelman (1975) that the problem of defining health in medical school is usually obviated by the assumption that health is the absence of illness. Dolfman (1973) agrees that this is the most popular and widely accepted view. While Wylie (1970) attempts to avoid such a negative approach, he eventually succumbs to using it as he concludes that "disease is the crucial concept to be understood and health is the term given by society to those without known disease".

Diseases however are taxonomic formulations of medical scientists, not of patients and the public. Their/

Their primary concerns are to do with their subjective perceptions of alterations of function, behaviour or feelings. Although some people arrive at a fairly sophisticated level of understanding of disease processes, the majority are precluded from more than a rudimentary and superficial acquaintance with medical conditions or their treatment. Such an unequal partnership between the seemingly omniscient doctor and the unwitting patient leads to professionalism where decision-making on all aspects of patient care is seen to be the sole prerogative of the medical fraternity. De Kadt (1976) echoes this sentiment with his comment about doctors that "what makes them good medical men (a capacity to diagnose and treat the sickness conditions of individual patients) is also likely to influence or even distort their judgement on matters of health; and that expertise in medicine is not the same as expertise in health".

The application in medicine of the methodologies seen to be pertinent to the natural sciences has resulted in the development of a definition of health in which illness is conceived to be biological, explicable according to the laws of physics and chemistry, and treatable on an "individual bio-chemo-surgical basis, relegating the recognition and implications of social causes of illness to secondary importance" (Kelman, 1975). This approach results in a point of view which is "reductionist, which says that all behavioural phenomena of disease must be conceptualised in terms of physicochemical principles, and exclusionist, which says that whatever is not capable of being so explained must be excluded from the category of disease" (Engel, 1977). But/

But perhaps most ruinous of all for the practice of medicine in general and for community medicine in particular is that rooted within such a concept of health are the seeds of empiricism. The dangers of applying an empiricist approach have been explored by Mills (1959, p 68). He points out that, "The style of social research I have called abstracted empiricism often seems to consist of efforts to restate and adopt philosophies of natural sciences in such a way as to form a programme and canon for work in social sciences". Furthermore in medicine the problem is compounded by its intricate blend of the natural and social sciences.

Clearly there are many occasions when the approach used by the natural scientists is desirable. Their aim is to make accurate predictions, and their methodologies are governed by this need to make observations and design experiments which will discover the exact circumstances under which objects with similar properties will behave in a given way. The empiricist is convinced that given time to develop more sensitive data collecting techniques and the submission of such data to more complex and sophisticated analytic methods, even human behaviour itself is predictable. I would, however, suggest that this approach is inadequate if one believes that Man is a social animal because it fails to come to terms with Man's complex social and cultural environment. Unfortunately, the empiricist's preoccupation with methodology leads him to ignore the concrete behaviour of people, as this requires that the researcher face up to substantive problems demanding understanding and quests for solutions using approaches not to be found in the repertoire of the natural scientist. Thus/

Thus, the medical empiricist tends to immerse himself in rather abstract issues frequently of his own making, issues unimportant to the general practice of medicine but which in effect endanger medical practice by deviating it from its purpose and course.

The biomedical model is by no means our only disease model. "Old wives' tales" or folk models are examples of non-scientific models founded deep within our culture. Today, the biomedical model has become our folk model, a development noted by Engel (1977). "The historical fact we have to face," he wrote, "is that in modern Western society biomedicine not only has provided a basis for the scientific study of disease, it has also become our own culturally specific perspective about disease, that is, our folk model. Indeed the biomedical model is now the dominant folk model of disease in the Western world." He develops this point much further, as he believes that, "The biomedical model has thus become a cultural imperative, its limitations easily overlooked. In brief, it has now acquired the status of dogma. In science, a model is revised or abandoned when it fails to account adequately for all the data. A dogma, on the other hand, requires that discrepant data be forced to fit the model or be excluded."

By effectively excluding the vast majority of the population from contributing to our ideas of health, ignoring the social and mental components of health, attempting to explain all ill-health on the basis of the physicalistic laws of the natural sciences and/...

and making a fetish of their methodologies, this disease model has indeed become a dogma, indicted for professionalism, exclusionism, reductionism and empiricism with little relevance to reality as it exists for the majority of the public.

In recent years adherents to the biomedical model have attempted to refute some of these criticisms. Lewis (1953) tried to extend the biomedical model to include mental disease, pleading that "Health is a single concept: it is not possible to set up essentially different criteria for physical health and mental health." However he still subscribed to the view that, "There are no positive indications of health which can be relied upon, and we consider everyone healthy who is free from any evidence of disease or infirmity", and baulked at the idea of a social component of health. Most health workers now accept a mental component of health (Susser, 1974), although this is frequently formulated within the framework of the biomedical model. Engel (1977) has severely criticised psychiatrists who adopt such an approach. He considers this model "no longer adequate for the scientific tasks and social responsibilities of either medicine or psychiatry." An attempt too has been made to include social diseases in the model, a fact noted by Kelman (1975). He considers that the second stage of development in the concept of health following the first "universal-mechanistic" period was what he calls "asocial-developmental", ushered in by Chadwick, and in which the individual interacts with the social environment. Kelman/

Kelman, while recognising this concept as an advance, nevertheless criticises it on the grounds that it still views health as a universal notion independent of the form of society in which it is being investigated. Factions remain still, however, which refuse to accept that the concept of health must include a social component within its terms.

2.2. 2. Health as a State of Complete Physical, Mental and Social Well-Being

Many definitions and models of health have been constructed as alternatives to the biomedical model of disease: Dolfman (1973) discusses eight models, Cardus and Thrall (1977) list four definitions and Goldsmith (1972) eight, with further contributions by Audy (1973), Cardus (1973) Chiang and Cohen (1973), Dolfman (1974), Dubos (1960), Dunn (1959), Engel (1960, 1977), Fanshel (1972), Gelfand (1976), Kelman (1975), Lerner (1973), Lewis (1953) Patrick et al (1973a), Purola (1972), Sheldon (1974), Smith (1977) Susser (1974), Terris (1975), and Wylie (1970). Without doubt, however, the model which has made the greatest impact and around which most of these authors have conducted their debates is that of the World Health Organisation (1946) that "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

Such a paradigm clearly expands our concept of health to include with the biomedical model the notion of physical, mental and/...

and social well-being, positive qualities relating to how people actually feel, so obviating the dangers of professionalism, exclusionism and reductionism. In addition, by implicitly raising the possibility of dialogue between health professional and layman in the determination of health, it provides a framework in which empiricism may be avoided. The WHO concept of health has, however, been subjected to extensive criticism.

As he cannot conceive that a social component to health exists, Lewis (1953) cannot accept the validity of the WHO definition since this concept is fundamental to this idea of health. Kagan and Levi (1974) adopted an empiricist approach in their attempt to prove that social factors can cause disease but eventally concluded that "causation of disease by psychosocial stimuli is unproven but at a high level of suspicion". Others, however, have accepted that social factors must be implicated in any attempt to conceptualise health. Jus (1973) while echoing some of Lewis's criticisms, accepts such a social component of health. Engel (1977) pleads for what he calls a "biopsychosocial" model of disease in which he combines the physical, mental and social causes into one whole entity, a view strongly supported by Byrne and Thompson (1972). Kelman (1975) records that the aetiology of disease is a "complex dialectic between the organism and socially induced stresses", and Purola (1972), using a systems approach to health, seems to be in accord when he comments that illness is a disequilibrium between man's "internal psychobiological system and his external system of social connections". Lerner/

Lerner (1973) placed even more emphasis on the social element of health in saying, "Health is more than just a biomedical phenomenon; it involves a social human being functioning in a social environment with social roles he must fulfil." The social causation of health and disease is emphasised by Cardus (1973), Dubos (1960, p 25), Fanshel (1972) and Lamm (1972) while de Kadt (1977) reiterates this belief even more bluntly. "Health has less to do with medicine," he declares, "than with economics, class and politics." Perhaps most emphatic of all is Kelman (1975) who insists that "a new paradigm in the science of health must be adopted: one that recognises that health behaviour, in any society, is socially determined even to the extent that 'health' itself is primarily socially, rather than strictly biologically, determined; it is largely a socially determined category predicated upon the particular characteristics and dynamics of the society under investigation."

Two further criticisms which are closely linked are concerned with a tendency of the WHO definition to transform what is essentially a dynamic process into one of a static nature (Draper et al, 1976), and to create two distinct entities, namely those of health and disease (Wylie 1970). This dichotomy into health and disease is questioned by Dunn (1959) who puts forward the notion of a "wellness grid" ranging on a continuous scale from "poor health" to "high level wellness". Engel (1960) notes the lack of sharp dividing lines between health and disease and the fact that health and disease may not be mutually exclusive is pointed out by Terris (1975). These/

These views receive the support of Byrne and Thompson (1972) who believe that health is a constantly changing phenomenon in which we should talk about a "wellness continuum" rather than a dichotomy. Chiang and Cohen (1973) agree that "the health of an individual is a dynamic phenomenon, varying on a continuum from optimum well-being to extreme illness". However the dynamic-continuum and the static-dichotomy views are perhaps much closer linked than they at first appear, for these latter authors continue, "An individual's health at a given instant may be represented by a point on the continuum", and this point presumably would fall towards one end or the other of the health-ill-health grid.

Perhaps a more fundamental criticism of the WHO definition is that it rests on an aspiration to an ideal unattainable state (Dolfman, 1973), and its imprecision and comprehensiveness make it impractical for the purposes of measurement. Jus (1973) and Lewis (1953) fully support these sentiments and the latter sees the WHO definition as a description of health pertaining to a state of perfection "such as was enjoyed perhaps by archangels and by Adam before the Fall" and "realized in the Golden Age but long since forfeited". It is however pertinent to note that the substitution of mysticism and mythology for historical accuracy may reflect upon the author's own philosophical outlook on life, but it fails to throw any illumination on the WHO concept of health. Terris (1975) believes that although the latter has a "Utopian aura", on closer examination it reveals a pragmatic outlook. He proposes, among other things, to delete the word "complete" on the basis that health is not absolute, a sentiment shared by Gelfand (1976). A/

A WHO study group itself (WHO, 1957) has recognised all these difficulties when it stated the definition is a "very proper ideal; it indicates general goals to which we may continually strive". Health, it noted, could be regarded as being of two main orders, one broad and abstract, the conceptual, the other narrower for working purposes, the operational. These experts felt that the challenge therefore was to "study further the definition given by the WHO, with the object of making it more precise" so that it could be used operationally with more clarity. Susser (1974) supports this view by rejecting the main criticisms as appearing ill-advised when he comments, "There is more danger in encouraging the fallacy that what can only be narrowly measured must also be narrowly conceived, than in aspiring to measure or attain an ideal. Moreover, by imaginative methods, the definition can probably be made operational." Weight is added to this belief by Breslow's (1972) acceptance of the challenge posed by the generic nature of the WHO definition and by his apparent ability to convert it into quantifiable terms.

The WHO definition of health does not of course describe the characteristics of a healthy person. How then are we to approach the task of making it operational? I believe that the most central issue here lies in the realisation of dialogue between health professionals and members of the community at large, the importance of which has been emphasised both by Mahler (1977) and by an expert committee of the WHO (1974). Of course the idea of dialogue is not new. Intraprofessional dialogue has always been the cornerstone of normative definitions of health. The/

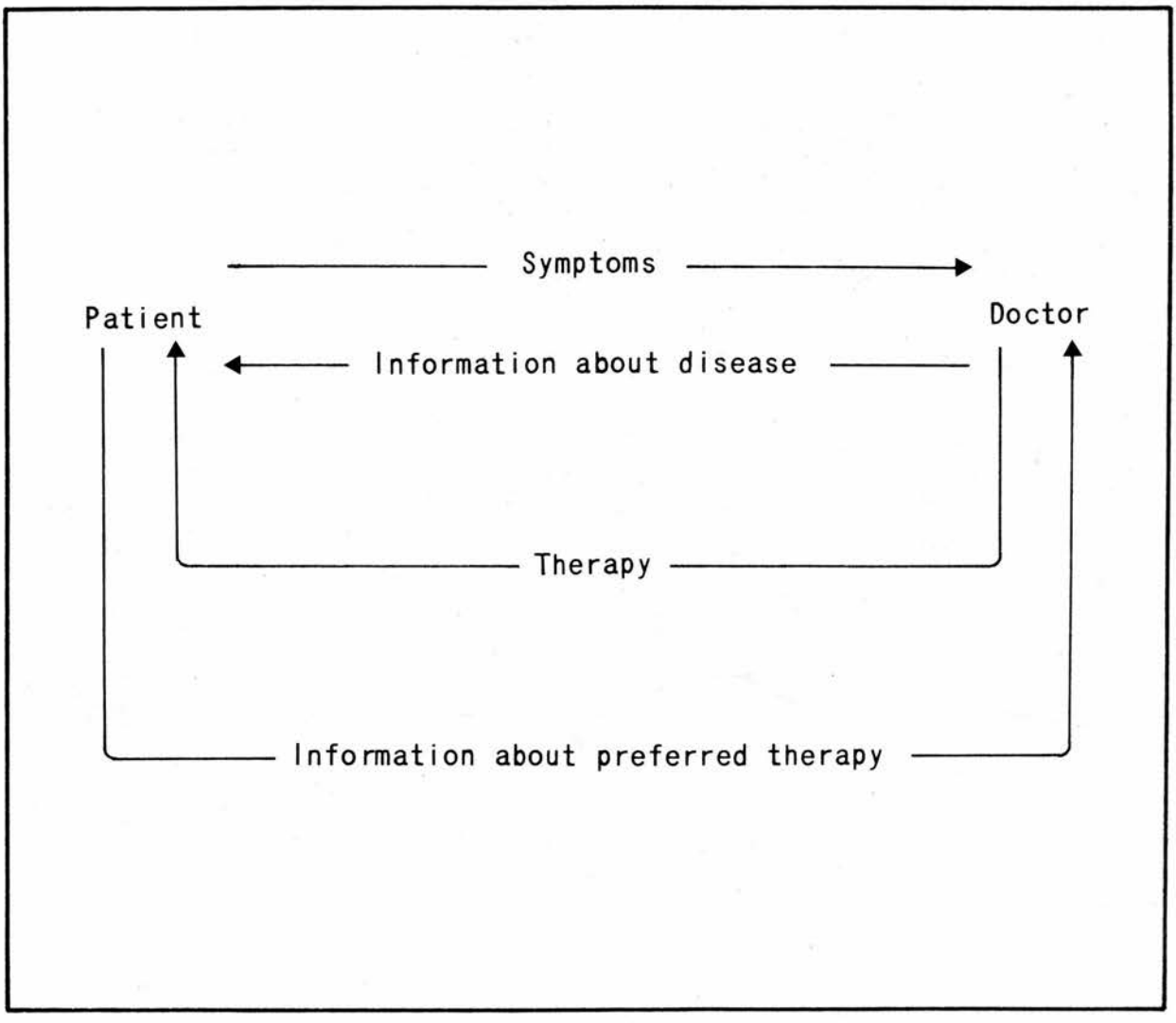
The need now exists to extend this dialogue beyond the professional pale to involve the whole community. It is to be hoped that, through conducting such a dialogue, one may arrive at an approachment of the two commonly adopted perspectives to health, neither of which, alone or separate, is sufficient to provide a basis for the understanding of the determinants of health within a community or for an individual. The normative being the perspective of the professional is measured largely by the absence of disease or infirmity, while the subjective is that of the patient or potential patient as assessed by his or her feeling of well-being, an experience described by Mills (1959, p 17) of a cherished set of values to which no threat is felt. Only when the normative and subjective perspectives are synthesised by dialogue can proper account be taken of the individual members of the community and the social context within which they live. Only in dialogue, moreover, can a true perspective be obtained of the relevancy and appropriateness of the complementary systems of health care devised by society to deal with the disruptive effects of disease and ill-health.

A simple example of the importance of dialogue may help to clarify this point. Elderly patients, newly diagnosed as having diabetes mellitus, frequently claim to feel perfectly well, and deny all symptoms. It is only after commencement of specific therapy that they then remark on how much less often they now need to pass urine. Their subjective feeling of well-being before treatment fails to reflect their true potential, which only becomes apparent after their doctor, in the knowledge of what can be done and after dialogue with the patient, institutes therapy. Equally/

Equally there are many patients without objective signs of disease but whose symptoms of lack of well-being nevertheless clearly identify them as unhealthy and in need of care. The type of care or treatment most appropriate in any given situation is also best determined by dialogue. Lack of dissatisfaction with health care provision is too often the result of the lack of awareness of what can be done rather than the existence of an adequate service. In the individual patient-doctor situation Sheldon (1974) has considered such dialogue an essential requisite, and illustrates it as in Figure 2. Here the patient is informed in a way he can understand Sheldon comments, "and is part of the decision process affecting him".

As already noted, however, the dialogue need not and should not commence at the symptomatic stage. It should be extended even earlier than the presymptomatic stage too, to include that of health, and in so doing involve not only the individual person but also the whole community. Surely, it is in this direction that one can conceive the role of community medicine. The scientist can function in this field by developing working models of the WHO concept of health, by collecting data which serve to educate and facilitate dialogue, and by commenting on this dialogue between patients, potential patients and health professionals. By determining the existing position, ferreting out the substantive problems, assessing what medical science can actually do, what it can do well, what not so well, what not at all, and/...

Figure 2: The Patient-Doctor Dialogue (from Sheldon, 1974).



and by documenting the resources available to the health services to tackle these problems, the scientist can make a positive contribution to aid both sides in the decision-making process of appraising what needs to be done to improve health, and what facilities must be provided to accommplish this. Campbell (1977) stresses that such discussions must be conducted with members of the public and Lock (1976) reiterates the same thought, adding that there is a need to develop a situation in which the general population is more informed than it is at present. The latter laments the lack of debate on health issues and looks forward to the day when all sections of the community will participate in a fuller debate on health. "Health", he concludes, "must surely benefit from more and better public discussion than it gets at present."

2.3. An Operational Definition of Health

The discussion up to this point has centred largely on the development of the theoretical components within the concept of health. However, an essential element of any successful model is the degree to which it can be applied to reality. This reality can only be reached when we resolve the problem of what is to be measured and how this is to be quantified.

Most authors agree that there are general objectives for measuring the health of the community: to assist the public and their representatives in the allocation of resources, to assist the public and health service administration in the evaluation of the effectiveness of health services' delivery systems and for the/...

the "scientific" purpose of comparison (Berg 1976; Colyer 1976, p 32; Goldsmith 1972; Lerner 1973). Furthermore, Lerner claims that this last purpose aids in the discovery of the "true" nature of social reality, "independent of any practical application", a widely held view with all the hallmarks of empiricism. Broadly speaking then, these workers seem to agree that the "human" purpose (Mills 1959, p 149) for measuring the community health status is to determine what can be done to improve the health of the community, and to examine whether acts deemed to fulfil such functions are being carried out and in the best manner (WHO 1960). These criteria are extrapolations of those applicable to the measurement of the health of the individual (Byrne and Thompson 1972), although Cardus and Thrall (1977) are of the opinion that different approaches may be required for both these tasks.

The broad characteristics which determine health status and hence ought to be the focus of our attention have been widely discussed. Cardus (1973) believes they have to do with Man's ability to function at his optimal level, characteristics which also exhibit his capacity to adapt to the environmental changes affecting his pattern of living. Terris (1975) lists four approaches; measurement of performance, studies of capacity for performance, measurement of impediment to performance and studies of subjective feelings. Audy (1973) agrees that adaptability to rally from challenges is an important determinant of health and suggests that the speed and success of such reactions would be relevant factors to measure. Dolfman/

Dolfman (1973; 1974) considers that health at the operational level involves the three concepts of functioning, adapting and mormality, noting that these all imply value judgements which must be considered in relation to social and cultural norms. Smith (1977) also considers performance or function must be related to cultural norms and to the idea of normality. "To be realistic", he comments, "we must relate our ideas to some concept of what is reasonable for the average citizen, as affected by age, sex, and the normal vicissitudes of life."

However, considerable problems exist in relation to the concepts of adaptation and of normality. The first lies in the fact that the characteristic which, above all others, distinguishes Man from other animals is his ability to adapt what is essentially an asocial dehumanised vacuum into a social environment to suit himself, not the reverse, as is implied by those who advocate adaptibility as a criterion of health. Further, as noted by Jus[illegible] (1973), the ability to adapt may in truth be a feature of ill-health, not of health. Thus, it follows that the lack of adaptation, especially to adverse social and environmental situations, may be an even more appropriate measurement of the health of an individual.

The issues raised by the notion of normality are no less problematic. Normality is statistical in nature, an arbitrary, mathematically-derived concept which evolves with time and is applicable only to defined populations, and inappropriate in measurements to do with specific individuals. Of/

Of course, some individuals are qualitatively as well as quantitatively different and little difficulty arises over differentiating them from their more healthy peers, but, nevertheless, a large grey area of ignorance still prevails (Cochrane 1972 a), thus belying the usefulness of this notion as a determinant factor of health.

Another aberration which has appeared in the literature is the role of prognosis in the measurement of health (Fanshel and Bush 1970). Patrick et al (1973 a, b) felt that health status should be conceived as a composite of an individual's level of function at a point in time and his "expected transition to other levels, more or less favourable, at future times". In this view, health status is assessed not only in relation to function but also in relation to the "probabilities of transition among the levels over the life expectancy of an individual or a group". Chiang and Cohen (1973), Chiang (1976) and Kaplan et al (1976) agreed with this approach and proclaimed that a basic concept underlying their index was the "expected duration of stay" for each individual in each health state during the year, and that this should be assessed on the basis of "transition probabilities". This approach of course involves the accurate prediction of the future health behaviour of individuals based on the past experience of different groups of individuals in ostensibly similar health states. While all practitioners of medicine attempt this to a certain extent, they invariably shroud their predictions in caveats, fearful of the unexpected they know from bitter experience is all too common. Because/

Because of the inherent uncertainty of this empiricist technique and moreover as its adoption automatically divorces us from the concrete behaviour and reality of human beings as patients as they present to practitioners, there appears little scope for incorporating prognosis within our assessment of health, except in the loosest of ways.

If we reject as inapplicable the concepts of adaptability, normality and prognosis in our attempt to measure health we are left with function, performance and subjective feelings as major components of the measurement of health. All are central to any notion of health, and it is generally agreed that the ability to function and perform effectively within one's own environment are characteristics of the healthy individual. Bearing this in mind Smith (1977) has suggested that two ways in which a community may promote the health of its members are to minimise the amount of impairment and to devise a greater number of acceptable roles within its environment so that few individuals may feel unable to undertake them. Both means are important and their creation and sustenance depend on continuous dialogue between health workers and the members of the community. The major practical difficulty posed by adopting such an approach is to discover a method which will give a summation of the information ensuing from such a dialogue so that it may provide a meaningful and useful assessment of the health of the members of the community. Sheldon (1974) has already suggested a form of dialogue useful in the assessment of the health of any individual and it may be that community health may be similarly evaluated by the use of health indicators.

2.3. 1. Health Indicators

An expert study group of the WHO (1957), on the basis of previous work commissioned by the Health League of Nations (Stouman and Falk 1937) considered that a suitable working classification of health indicators was as follows:

(a) those associated with the health status of the individual or group;

(b) those related to environmental conditions;

(c) those concerned with health activities.

They also noted that, whereas most of the indicators in current use were of the macro type, applicable to the population of a country as a whole, there was a great need for indicators to be constructed with reference to individual persons, households and communities, that is, at different micro levels.

A subsequent expert committee of the WHO (1960) recommended this approach in the study of local health services, and illustrated how this might be accomplished.

It is to be regretted that although much recent research has been commissioned on the subject of health indicators (Berg, 1976) it has concentrated on their use for carrying out "scientific" comparisons and not on the type of study envisaged by the WHO. This/

This empiricist approach has had unfortunate consequences. It not only makes a fetish of the indicators themselves regardless of any practical use to which they may be put, but also encourages the search for an all-embracing, powerful, unidimensional index. Wylie (1970), for example, alludes to the similarity between measuring health and temperature, a similarity more apparent than real, for as Lerner (1973) has observed, health is a multidimensional concept. Yet this realisation did not prevent him from continuing, "Perhaps the most difficult aspect of the measurement process is to combine, in a manner that is not purely arbitrary, mortality, morbidity and impairment into a single index." Many other workers, too, have constructed indices of health, measured on a linear scale from 0 - 1. Within this group comes the Health Status Index (HSI) (Fanshel and Bush 1970; Fanshel 1972; Patrick et al 1973 a, b), the Sickness Impact Profile (SIP) (Carter et al 1976) and the indexes proposed by Grogono and Woodgate (1971), Chiang and Cohen (1973) and Chiang (1976). But surely any attempt to include disparate variables in a single index must inevitably be arbitrary. It is regrettable too that the empiricists' preoccupation with the methodologies of the natural sciences, does not include the same level of intellectual rigor shown by the established sciences; no physicist in describing the physical properties of any substance would weight such factors as mass, volume, temperature, electrical conductivity, etc. with the object of combining all his observations into an overall index. Yet this is what those searching to establish an overall index of health are doing. That/

That such an approach is inappropriate is stated clearly by Draper (1976 p 31), "The idea of health in its widest sense would therefore seem to incorporate a number of dimensions or aspects which it would almost certainly be difficult to denote in a single all-inclusive definition." Chen (1976 a), too, acknowledges that the utility of a general status index has not gained universal acceptability.

Amongst other reviewers of health indicators in current use Goldsmith (1972) examined nine and concluded that all but the grossest indicator, mortality, require some degree of value judgement, but was unable to offer suggestions on how this might be taken into account. Chen and Bryant (1975) reviewed 4 population, 8 individual and 4 mental health indexes but concluded that major problems of validity, reliability and feasibility remain unsolved.

The expert study group of the WHO (1957) noted that health indicators in current use included both comprehensive mortality indicators such as proportional mortality ratio, expectation of life, as well as crude death rate and specific mortality indicators such as infant mortality and death rates from communicable diseases. They felt that indicators of health services and activities in common use were more specific in nature and called for more work on morbidity studies, nutrition, mental health, environmental sanitation, health services and socio-economic conditions. This approach to health indicators is highly practical and served as a model for the investigation of local health services (WHO 1960), in which all these factors were taken into account in order to build up a comprehensive/...

comprehensive picture of the health of individuals, and hence of the community in which they lived. The report suggested two lines of approach. Firstly, it recommended that a comprehensive account should be compiled of the health service facilities in the locality, and of the general social and economic situation. Secondly, it advocated a "family health study" to ascertain the state of family health and to find out "if the health services of an area reached down to the people and were used by them". This approach clearly contrasts with the empiricist's search for an all-embracing index of health which inevitably would be of doubtful significance. However the problem of appropriateness of the health services to the needs of the population remains. Cochrane (1972 b) suggested these should be measured against the criteria of effectiveness and efficiency, and McKeown (1976) added standard of care as another factor involved. Neither author, however, was able to come to terms with the process of measurement of these qualities. Cochrane's approach was based on his own personal assessment of effectiveness and efficiency and at best could only be considered as a professional one. McKeown (1976) in his more sophisticated critique, recognised some of the difficulties inherent in such a view, but could not offer a means of measuring health in a positive way which would overcome the problems of subjective judgement.

I believe that the solution to this enigma lies in the recognition and acceptance that all assessments of effectiveness and efficiency of health care and of validity, reliability and feasibility of health measurement must be subjective if they are to have any relevance to reality. What/

What may appear real to Cochrane (1972 b) however, or to medical men as a whole, may be no more than schizophrenic delusions when measured against the yardstick of reality as seen by the whole community. Herein lies the challenge. As previously outlined only in the development of dialogue between health professionals and members of the community can we face up to the difficulties associated with indices of health which incorporate these value judgements. By this means the WHO approach to health can be made real by the adoption of criteria determined not simply by an elite group of professionals, but by the whole community. The development of this dialogue should be seen, therefore, as the link between the medical scientist and the individuals within the community which converts individual subjectivity into what is reality for the whole population.

3. The Health Implications of Coalmining.

The previous chapter outlined an approach to health, and a method of measurement has been suggested. This method is based on a dialogue using the WHO definition of health. The need to take many factors into consideration before arriving at an overall assessment of the health of a group or community has been emphasised. This chapter reviews some of the approaches and methods used by other researchers in their studies of the health of coalminers and that of their communities.

3.1. The Historical Perspective

To understand the health implications of coalmining it is necessary to bear in mind the past history in its widest sense both of coalworkers and the communities of which they have been a part. In Scotland this history has been extensively reviewed by Arnot (1955), Duckham (1970), Johnston (1946) and the National Coal Board (1958).

Coal deposits or 'coal-heughs', as they were known in Scotland, were first systematically worked to provide fuel for the salt pans around the coastal regions of the Firth of Forth in the twelfth and thirteenth centuries. At this stage monastic orders worked coal outcrops only, and did this under baronial charter using chattel slave labour. By the fifteenth century the pit-and-adit method was in use and chattel slavery had given way to feudal serfdom. Serfs replaced slaves mainly because of the economic requirements of the Church estates and as a result of conflict between the monarch and/...

and the barons (Johnston, 1946 p 16) The coal pits were some 20 m deep with an adit or drainage tunnel to remove water from the workings. Miners stripped the coal and bearers, generally their wives and daughters, carried the coal to the surface. By the year 1500 when Scotland's population was around half-a-million coal output was less than 40,000 tons annually, but by the latter part of the sixteenth century the introduction of proper pits with water-gins to prevent flooding of the workings allowed coal production to expand greatly.

Little is known of the conditions of life and work in these early Scottish coalmines. However, one can surmise that these must have been extremely bad since the Scots Parliament in 1606 found it necessary to enslave salters, colliers and coal-bearers to maintain production and prevent their leaving for more congenial work elsewhere. In 1641 this was extended to include other coalmine workers. An Act of 1617 led to the introduction of 'arling' by which an indigent collier would bind over his child at baptism to his master, a practice which rapidly became universal among Scottish coalminers. In 1641 a maximum wage was fixed for colliers of £1.12½ per annum for a compulsary 6-day week, 52-working-week year. A fine of £1.00 and the thumbscrews or pilliwinks were the penalties for failure to comply with these contractual obligations. Even this, however, was insufficient to supply the demand for mine labour and a further Act of the Scots Parliament in 1661 bound colliers to their masters for life. In 1672 the right to press unemployed poor into servitude in the mines was conferred upon the coal owners as a/...

a further aid to recruitment.

By the year 1700, the population of Scotland had risen to around one million and half-a-million tons of coal were being mined. About 3,000 men, women and children, worked in the mines and a further 12,000 people, chiefly on the shores of the Firth of Forth but by now spreading into Lanarkshire and Ayrshire, were dependent on the industry for a livelihood. Although these collier-slaves seem to have been paid more than other labourers, there was a stigma attached to mining, and they were very much regarded as a class apart, perhaps an inevitable consequence of the enforced segregation of mining families from the rest of the population. Indeed, throughout the eighteenth century miners, their wives and children worked 12 to 16 hours a day, six days a week, and were specifically forbidden to rest even on public holidays and feast days. Economic necessity compelled miners to have bearer-wives and this in practice meant that colliers almost always married within their own function group. All these factors combined to ensure that miners had little contact with the outside world.

By the latter half of the eighteenth century, the industrial revolution in Scotland was gaining momentum and more coal than could be dug by this small band of collier-slaves was needed to fuel the new iron and other industries. The necessity to increase recruitment into the mines, and the impossibility of doing this under the prevailing conditions of servitude led to the complete abolition of mine slavery and serfdom in Scotland in 1799.

The nineteenth century saw rapid changes in mining technology and in conditions of work and life among the mining communities. Paradoxically advances in technology which might reasonably have been expected to improve the conditions of work of the colliers in fact led to a deterioration in their lot. The Boulton and Watt rotary steam engine which became popular around 1800 and the Davy safety lamp, introduced in 1815, both resulted in an increase in the number of deaths from accidents, not the reverse, since deeper, wetter, more gaseous seams were worked then would have been possible in earlier times. Indeed firedamp, or methane gas, was uncommon in Scottish mines before the nineteenth century, but became more of a problem thereafter.

In 1842 the Children's Employment Commission found that a quarter of all pit workers in the East of Scotland were aged between 7 and 13. Following its report women, girls, and boys under 10 were forbidden to work underground, although this practice did not cease completely until the 1860's. The same Act of Parliament established inspection of pits, and the first government inspector of mines, Hugh Seymour Tremenheere, took up office at the end of 1843, although on no occasion during his tenure of office did he ever venture down the mines. Underground inspection did not become a reality until the 1850's (Buess, 1962). In 1862 all mines had to have two exits, and a major extension in mining safety was ushered in by an Act of 1872 allowing workmen's inspectors. The restrictive nature of the legislation, however, prevented effective workmen's inspection until shortly before the First World War.

Conditions in nineteenth century Scottish mining towns were exceptionally bad. Streets without paving, miners' rows without sanitation, poorly constructed, overcrowded room-and-kitchen houses, or "but-and-bens", and a general lack of amenity made unfavourable comparisons even with the worst urban slums (Cauldie, 1976). Diet was variable but probably no worse than other labourers'. Trucking however was widespread. In this method of payment mine owners gave part or all of their colliers' wages in provisions purchased from "tommy shops", shops owned by the mine owners themselves. Their prices were much higher than elsewhere (Johnston, 1946, p 342). This and the practice of trucking alcohol "on the slate" had detrimental effects on the diet and health of the miners and their families. Hours of work, too, were long, and an eight-hour day was not introduced nationally until 1908.

The years 1910 to 1920 saw coal production at its greatest and the workforce reached a maximum throughout Britain of one-and-a-quarter million. By the outbreak of the Second World War however this had fallen to three-quarters of a million including 2,300 women and 13,500 boys under 16. The first medical inspector of mines took office in 1927 and by the end of the War there were 10 Mines' Medical Officers (Fisher, 1944).

When the coal industry was nationalised on the 1st January, 1947, 196 Scottish mines came under the direct management of the National Coal Board and a further 79 were left under the direction of their previous owners. Even/

Even in the early post-nationalisation period, most boys born in mining towns and villages had little choice over their lives. It had already been charted out for them by their place of birth. They saw their future as following in the footsteps of their fathers, uncles and elder brothers "down the pits". Nearly all able-bodied boys living in these mining villages became coalminers when they left school, a position which had, of course, existed for centuries. This situation affected not only the health of the coalworkers themselves, but also that of everyone else residing in these communities. Miners had always worked in a poor environment and had low expectations both of health and from the health services. These sentiments pervaded the whole community and resulted in an equally poor living environment and a lack of priority in supplying amenities to mining towns.

The post-nationalisation period has, however, seen great changes in mining areas. The development of public housing, the introduction of pit-head baths, compulsory retirement at 65, and the widespread closures of coalmines with the resultant diversification of labour or unemployment have all exerted their influence. Moreover, it is now by no means inevitable that the sons of miners will take up the same occupation as their fathers. The close-knit nature of their communities, however, has not yet been completely destroyed, and many of them retain much of the flavour and distinguishing features associated with their past. Although only 24 mines were being worked by the Scottish area of the NCB and only 17 under licence in 1975, the NCB still had nearly 29,000 employees and remains the largest/...

largest single industrial employer in Scotland (NCB, 1975).

3.2. General Considerations

Any examination of the literature on health or ill-health related to coalmining soon reveals two important features, an empiricist approach to the problem, which has tended to dominate thinking for many years, and medico-legal considerations associated with compensation for industrial injury and disease. Both have served to divert medical scientists from the central problems and have led them to adopt research methods ill-suited to probing the complex issues involved.

Many, for example, have attempted to compare various indices of mortality and morbidity in working miners with those of other workers without realising that such comparisons are generally inappropriate to the study of the health problems of such a highly selected group of men, whose fitness on entry into the mining industry invalidates such comparisons. A more appropriate question is "To what extent does mining experience adversely affect health?" Although this may be the question many researchers have attempted to answer, their methodologies are frequently inadequate to do the job properly. They would require to follow-up cohorts of new recruits over prolonged periods of time, a time-consuming and difficult exercise. Most researchers study working miners; the more sophisticated of them apply their energies to cohort studies which include working miners and ex-miners. Yet any longitudinal study which starts with a cohort of working miners excludes all those who/...

who have already left and inevitably distorts the true picture.

Medico-legal considerations revolve round the question of blame. This whole problem has recently received the attention of the Pearson Commission, the recommendations of which included "no fault" schemes for compensation for injuries or death from accidents. The absence of such schemes in the past has resulted in attention being diverted from the health implications of coalmining to questions of blame, liability and compensation. Much research, too, has been concerned with isolated, abstract issues, with little notice paid to overall health, or to the health services and health care delivery. Even less attention has been devoted to the appropriateness of health care to the needs and wants of the coalworkers themselves.

The effect of this situation is clear: even 30 years after nationalisation of the coalmining industry in this country, we do not have comprehensive accounts of its health implications, a state of affairs which reflects adversely on the health services in general and on those with an interest in epidemiology in particular.

3.3. Coalminers' Mortality

The decennial supplements of the Registrar General remain the traditional sources of information on coalminers' mortality. In these the mortality experiences of various occupations are summarised in Standardised Mortality Ratios (SMR) or Comparative Mortality Figures (CMF). These statistics however are difficult to interpret for they contain sources of error quite apart from the well-documented/...

well-documented inaccuracies inherent in ascribing cause of death. Inadequate or incorrect descriptions of occupation may occur and this can affect both the numerator, the occupation recorded on the death certificate, or the denominator, the occupation recorded at the census. A further potential source of error arises from the multiplicity of names throughout the country for essentially the same job. Yet another lies in the fact that the information recorded at the census or on the death certificate is supposed to refer to the immediately antecedent occupation. Heasman et al, (1958) discussed all these difficulties in relation to mortality among coalminers and, on the basis of independent data, arrived at the conclusion that the death rate for all miners in 1955 was unlikely to be greater than the national rate for all males. This conclusion, of course, did not support that of the Registrar General which stated, rather, that death rates among miners were higher than among the general populace. Reid (1959) discussed this problem too, noting in addition that selection in the original choice of job and selective elimination, demonstrated so clearly by Edwards and Kerr (1960), were obviously complicating factors. Heady (1959) discussed the parallels between infant mortality and stillbirths and occupational mortality, noting that these may help to indicate that high mortality, apparently the result of a man's occupation, may not more likely be attributable to the general factors which also affect the rest of his family. Liddell (1960) felt that, intuitively, fit men in their youth performing arduous jobs will have more favourable mortality experience than men not fit enough to do such heavy work, and that the more arduous the job the earlier men retire from it. He/

He noted too the findings of Heasman et al (1958) that the greatest errors in the recording of occupation occurred in the older age groups, where, in the case of miners, promotion from a less arduous more recent occupation to face-work engaged in previously was a frequent occurrence, and suggested alternatives to the SMR and CMF as possible methods of overcoming this problem. Alderson (1972) confirmed major discrepancies in recording occupation on the death certificate in 10% of 591 deaths in one part of England in 1962 and recorded that more than half of his subjects were known to have had more than one occupation during their working life. He drew attention to the fact that the onset of occupationally induced disease frequently heralds the onset of declining work capacity and the need to change jobs, and stated that one method of obtaining a more accurate reflection between occupation and longevity would be to record, not the last known occupation, but the principal occupation at death registration. He felt, however, on balance that the administrative burden of obtaining a chronological occupational history outweighed any possible benefit. Liddell (1973 b) conducted a detailed enquiry into mortality in coalmining in 1961 comparing his personal census of both the coalmining industry and mortality in it in that year with occupational data attributed to coalmining on death certificates and at the census. He found considerable promotion into coalmining occupations, and more especially to face-work throughout the country and dependent on age at death and year of last appearance at work. In general he found that miners working underground had less mortality than all occupied and retired males but that surface workers had death rates above the national average.

Rates/

Rates in Scotland were higher than in other parts of the British coalfields. In a cohort investigation Cochrane et al (1964) and Cochrane (1973) found that non-miners had lower SMRs than miners and ex-miners, although he has recently reported preliminary results of a twenty-year follow-up of a random sample of miners, ex-miners and non-miners which suggests that the mortality experience of miners and ex-miners differs little from that of non-miners living in the same town (Cochrane and Moore 1978). This latter result is supported by Jacobsen (1977) who found that mortality, both of British and Scottish miners, was below the national average for all men. In his 18-year longitudinal study he found that the SMR between the ages of 15 and 64 for Scottish miners was 86 and for English and Welsh miners 81.

Fox and Collier (1976) noted that three factors contributed to low mortality rates in industrial cohort studies: first, selection of a health population for employment; secondly, survival in the industry of the healthier men, and thirdly the length of time of follow-up of the population. These workers found that mortality experience within 5 years of entering the vinyl chloride industry was as low as 37% of that expected and only progressively increased to the average 15 years after entry. In addition they found that, for those surviving 15 years after entry, mortality was 50% higher in those who had left compared with those who remained.

Clearly, many factors complicate survival studies in miners. Selection into employment is obviously important. Presumably only those who/...

who consider themselves sufficiently fit will apply in the first place for a job. Yet, in 1961/2 McLintock (1971) noted that nearly 10% of applicants did not take up employment, principally the result of physical defects found at medical examination. Even in 1975/6 2% of applicants were rejected for mining employment because of medical unfitness (NCB, 1976). Neither are longitudinal cohort studies able to give a complete answer since, by definition, they can only include at the time of inception, those fit enough to remain in the industry. Those who have already left the mines are therefore automatically excluded. The length of time of follow-up is also critical, and 15–20 years is clearly inadequate. It also appears to me that increasing the accuracy of data recorded on the death certificate or census will make little contribution to improving our information about miners' mortality, because fundamentally, the Registrar General is interested in last occupation, not in the contribution of occupational history to mortality. Cochrane and Moore's (1978) study, too, is misconceived. While it is interesting to note comparisons between the mortality of miners, ex-miners and non-miners within the same town, the very fact that the study area is a mining one, in itself makes the whole population, mining and non-mining, a class apart, a fact already noted by others, (Hart, 1971; Lancet, 1974). It is precisely because of the overall history of the miners and the way this has influenced the whole community in which they live, that such comparisons must be treated with great caution. The excess mortality among miners' wives and infants has been commented upon as one example of how a man's occupation affects others in the community (Ashley, 1968; Heady, 1959;/...

Heady, 1959; Lancet, 1974), and Hart (1971) has discussed in detail how the mortality of everyone in mining communities, not just the miners themselves, is higher than the national average. Attempts to isolate coalminers from the social milieu in which they live no doubt make interesting scientific abstractions, and as such are perfectly valid. That they are indeed abstractions, however, must be borne constantly in mind.

It would seem to me that in fact two different aspects of the problem are being confused. Heasman et al (1958) and Liddell (1973 b) tackled the problem of the mortality experience of working coalminers and Cochrane (1973) and Jacobsen (1977) extended this to include ex-miners in their cohort studies. The confusion arises from the assumption that the results of these investigations may be relevant to the broader question, "What effect does coalmining have on mortality?" This assumption is clearly not valid. It is often argued that even although the information from death certification is inaccurate, it may be more relevant to providing us with answers to this latter question, however. Supporters of this view argue that the obstinacy of relatives of deceased ex-miners in insisting on recording coalmining at death certification, long after the deceased had left this industry may be giving us partial answers to the problem. Only a longitudinal study of a cohort of recruits into mining can help solve this dilemma.

3.4. Disease Among Coalminers

The earliest known systematic account of ill-health associated with/...

with mining is the treatise "De re Metallica" of Georg Bauer, or Agricola as he is better known, published in 1556. A century and a half later Ramazini made observations on the health of miners and, on the basis of his findings, suggested that all miners should have ventilators, respirators, boots and gloves, as a means of improving their health at work (Holman, 1947). In recent years an extensive literature on all aspects of the health and ill-health associated with coalmining has appeared, and much of this has been collated and critically reviewed by Rogan (1972).

By any standards, coalmining is still an arduous occupation. The work is heavy and dangerous and even when conditions are good it is performed in an unnatural environment. Fisher (1944), then Chief Mines Medical Officer, attempted to minimise many of the health problems associated with the industry because he felt that an erroneous view of them had "added greatly to the difficulties of obtaining willing man-power to work in the mines". He qualified his views by adding, "It is worth noting that all mining industrial diseases are to a greater or lesser extent preventable." In addition to conditions specific to mining, Liddell (1973a) has shown that coal workers suffer from all the diseases that afflict other workers in his 5% sample census of the British coalmining industry in 1961-62. He included 34,000 spells of incapacity among 29,000 men employed by the NCB in the investigation, a summary of which is shown in Table 1. He found that, among this group miners were found to suffer much more incapacity for work than men in other employment, even in the most arduous "non-mining" jobs. Hart/

Table 1: Incapacity Among NCB Male Employees Aged 15 - 64 in 1961-62.

Cause of Incapacity	Number of Spells per 100 Men
Acute respiratory infection	45.2
Other respiratory illness	7.5
Arthritis and rheumatism	11.5
Injury	13.2
Disease of the stomach	15.2
Psychosis and psychoneurosis	2.3
Skin disease	4.4
Disease of the heart and arteries	1.7
Other disease	18.3
Total	119.3

Source: Liddell (1973 a)

Hart (1971) noted that inception rates among British miners and quarrymen for spells of incapacity for work in the same period covered by Liddell's (1973 a) survey were 1.82 times that of all British working men. Days of incapacity were 2.17 times the national average. Logan (1960) too found consultation rates in general practice were 124% of expectation among miners. Purely administrative consultations were 308% higher. Hart (1971) also detected high unemployment and high unemployability due to long-term sickness in/...

in his investigation of ill-health in his coalmining practice in South Wales.

There is a high drop-out from the coalmining industry. In a small study of only two collieries in 1957-58, Edmonds and Kerr (1960) found that nearly 5% of coalface workers left face-work each year (Table 2).

Table 2: Number of Coalface Workers Leaving Face-work Each Year per 1,000 Face-workers employed.

Died	2.7
Left mining altogether	12.6
Found alternative work within the industry	30.2
Total	45.5

Source: Edmonds and Kerr (1960)

Of 73 men who left face-work during the study period 6 died, 30 had some incapacitating injury, 25 had debilitating illness and 12 admitted the work was just too much for them. Amother point they were able to highlight was the relatively short working life at the face of these 73 miners. The average was only 21.3 years and the maximum only 33.3 years. It would be unwise to generalise from such a small, unrepresentative sample studied 20 years ago, but these findings do/...

do support general impressions that the working life of miners at the face is much less than the normal work span.

3.4. 1. Accidents

Until the industrial revolution the principal accidents arising from the mining of coal consisted of falls of ground and inrushes of water, but a new dimension was added to mining hazards when gunpowder was introduced in the seventeenth century. One need hardly guess at the effects of this latter invention on the health of miners prior to the advent of Bickford's safety fuse in 1831. As remarked before, instead of improving overall safety, the introduction of safety lamps and engines resulted in the mining of deeper, wetter, more gaseous, and hence, more dangerous coal seams. The widespread use of powered supports, however, is one comparatively recent and genuine advance in safety. Although methane, or fire-damp was common in some coalfields, it did not really become a problem in Scotland until the nineteenth century. As fires and explosions became more common, so too did the after-effects of these incidents, namely asphyxiation from black damp, a mixture consisting of nitrogen, carbon dioxide, and little oxygen, and from white or after damp, carbon monoxide. The use of machines for drilling and of dynamite for blasting towards the latter part of the nineteenth century and the increased use of mechanised transport systems all added new sources of danger from accidents.

First steps in the development of safety precautions were heralded by the Coal Mines Act of 1842, and the law in 1862 requiring mines to/...

to have two exits. Holman (1947) has characterised mine inspection up to and during this period as a "complete travesty". Indeed it was not until 1873 that statistics of accidents in British coalmines were collected at all.

In recent years considerable attention has been paid to accidents in coalmines, their effect on miners, and means of prevention. Tempest and Atkins (1958) investigated 4 underground gas ignitions involving 66 men with burns and concluded that clothing can be protective, if it itself does not catch fire. They recommended the wearing of safer clothing. Whitfield (1954) studied over two-and-half years one Nottinghamshire pit which employed around 2,000 men and documented 1,265 disabling accidents involving 1,384 miners. He concluded that young men had accidents because of inexperience, and the accident prone showed "deficiencies in perception and cognition", whereas older men prone to accidents were physically slow, and "deficient in motor response performance".

At his hand-clinic in 1952 Wilkes (1956) examined 119 miners with injured hands. In only two cases were there no financial losses as a result of the accidents and in half of them the loss was £5 per week or more. Over $\frac{1}{3}$ were off work for over 9 weeks and at least 8 men were permanently unable to return to the same job.

Knee injuries, too, are common and of importance to the mining industry. Atkins (1957) studied 100 consecutive miners admitted to a residential rehabilitation unit with damage to a knee cartilage,/...

cartilage, and noted that they were predominantly occupational in origin and that they caused serious economic loss and disability. He found many causes for these accidents including kneeling in narrow seams, conveyor belt injuries and slipping or tripping at the face, on the underground roadways, and on the surface. Osteoarthrosis was, he felt, a possible late complication. To prevent or lessen the effects of such injuries he suggested improvement in the design of miners' boots to reduce slipping, better "housekeeping" above and below ground, good walkways, better lighting, and the education of both miners and doctors on the necessity for immediate specialist advice if such an injury occurs. A different approach was adopted by Sharrard and Liddell (1962). They examined the hospital records of nearly 1,000 men who had menisectomies during a 30 month period in 5 hospitals in one of the largest British coalfields, and compared the findings with a reference population of a little over 1,000 from the same hospitals who had appendicectomies. Their data provided conclusive evidence that the rate of menisectomy was very much higher among miners than among other men. The finding that the proportions of different types of tears were similar for miners and non-miners suggested to them that the former were more likely to suffer cartilage damage of any type. From an examination of 80 consecutive patients, laxity of the knee joint was shown to result from kneeling, and this appeared to be the initiating factor in the majority of cartilage tears.

Liddell and May (1958) conducted a statistical study of coalmining/...

coalmining accidents. As they freely admit their data were of low quality, but nevertheless they felt able to draw several conclusions. They found that casualty rates decreased with age, especially for less serious injuries, and that young men under 21 and older men over 50 took longer to return to work after a serious injury than men aged 21 - 50. They found the highest casualty rates among coalface workers.

H.M. Inspectorate of Mines and Quarries, an integral part of the Health and Safety Executive since 1975, produces an annual report which documents and examines, among other things, accidents in coalmines with a view to their prevention. Its report for 1976 (Health and Safety Executive, 1977) shows that most fatal and serious reportable accidents were in underground transport (Table 3). For the past 8 years the incidence rate of fatal and serious accidents has remained static at around 1.15 per 100,000 man-shifts. Lawrence and Wyndham (1972) reviewed the problem of accidents in mines in respect of part of body affected, host factors, nature of work, agents causing injury, and environmental factors. Unfortunately, not one of their 23 references dealt specifically with coalmining and nearly all concerned accident studies overseas, principally in South African gold mines. The applicability of such work to British coalmines is not firmly established.

3.4. 2. <u>Occupational Lung Disease</u> /

Table 3: Number of Fatal and Serious Accidents in Coalmines in 1976 by Type and Location.

Location	Type	Fatal	Serious
Underground	Falls of ground	14	89
	Transport	15	187
	Machines	6	39
	Miscellaneous	5	124
Shaft and stable pit		5	5
Surface	Transport	1	17
	Machines	-	6
	Miscellaneous	4	68
Total		50	535

Source: Health and Safety Executive, 1977.

3.4. 2. Occupational Lung Disease

Morgan and Lapp (1976) have noted that the inhalation of coal dust can lead to the development of three pulmonary conditions, coal workers' pneumoconiosis, silicosis and industrial bronchitis, but these authors believe it is generally agreed that silicosis is of minor import for coalminers.

Meiklejohn/

Meiklejohn (1951, 1952 a, 1952 b) has reviewed in considerable detail the history of lung diseases in coalminers in Great Britain. Early reports appeared at the beginning of the nineteenth century with accounts of the symptomatology, clinical features and morbid anatomy of "anthracosis" or coalminers' pneumoconiosis, the latter term not being introduced until Zenker coined the word in 1867 (Meiklejohn, 1960). After great controversy throughout the century, and as a result of assiduous autopsy studies correlated with clinical observations, aided by the discovery of the tubercle bacillus by Koch in 1882, a degree of consensus was reached by the 1880's. It was felt that stone dust was the really noxious factor involved, that coal dust was relatively harmless, and further that tubercular phthisis was common in relation to the former, but rare in relation to the latter. Many doctors at that time commented that lung disease among coalminers was very much less than it had been only 50 years previously when, they also noted, it had caused severe social and economic problems to disabled workers. Their conclusions were that improved ventilation and sanitary conditions now prevailed and that these coupled with shorter working hours over this period, had mitigated much of the disease and its consequences. Over the next 40 years, moreover, the view that coaldust was harmless became widespread and all the emphasis on lung disease in miners focused on the presence of silica and silicosis. It was not until the late 1920's that this view became increasingly challenged. Doctors began once more, as they had done 100 years previously, to speculate about the aetiology, pathology, course and effects of pneumoconiosis; around/...

around that time, however, they were able to employ the new technique of radiography to help clarify the situation. The beginning of the present century saw rapid strides in the mechanisation of coal-cutting. Concurrently, pits were becoming old, deeper and with extensive workings far from the shaft. These circumstances combined to increase the dustiness of mine air throughout the workings and, along with the expansion of the labour force, pulmonary disability again assumed medical importance. In 1928, coalminers first became eligible for compensation for silicosis if they could prove that during the employment to which the disease was alleged to be due, they had been exposed to the dust of silica rock, and in 1943 coalworkers' pneumoconiosis became recognised as an occupational disease for which compensation is due.

disablement benefit

Since nationalisation of the coalmining industry some 30 years ago, an enormous amount of empirical research has been conducted into all aspects of pulmonary disease in miners.

Considerable attention has been paid to radiography as a tool in the diagnosis of pneumoconiosis. The importance of using standard films, especially by less experienced observers has been emphasised by Fletcher and Oldham (1951), film quality and technique investigated (Liddell, 1961; Wise and Oldham, 1963 b) and inter- and intra-observer error studied in detail (Fay and Ashford, 1960; Ashford, 1960; Liddell, 1963, Pearson et al, 1965). The assessment of radiological progression of pneumoconiosis has received attention too (Rae et al, 1963; Wise and Oldham, 1963 a) and a start made on the/...

the reading of chest X-rays by computer (Jagoe and Paton, 1975). However, considerable difficulties remain in assessing X-ray abnormalities (Liddell, 1977), and there is as yet no single authoritative classification of pneumoconiosis (National Coal Board, 1976). Since 1953 it has been generally accepted that the least unsatisfactory method is radiological and present classifications are based entirely on this technique. Briefly, pneumoconiosis is defined as the response to prolonged retention in the lungs of abnormal amounts of dust derived from coalmining operations. It is divided into two types, simple and complicated, the latter also being called progressive massive fibrosis or PMF. Both types are divided into a further 3 categories, 1, 2 and 3 in simple pneumoconiosis to describe the profusion and extent of the lesions and A, B, and C in the case of PMF, to describe the extent and density of the shadows. The current NCB Extended Classification divides each category of simple pneumoconiosis again into 3, thus producing an overall 12 point scale. There is much evidence to suggest that in simple pneumoconiosis X-ray categorisation reflects the total amount of dust retained in the lungs. Rivers et al (1960) and Rivers and Wise (1960) showed increasing dust content with ascending categories of simple pneumoconiosis in a small study of 45 coalworkers and these results were confirmed in a larger study by Rossiter (1972). There seems little doubt now that the most important environmental factor influencing the amount of dust present in the lungs in simple pneumoconiosis is the cumulative exposure to respirable dust and that this is influenced by the length of time spent underground, the airborne concentration of dust and the composition of the coal itself/...

itself (Bergman and Casswell, 1972; Jacobsen et al, 1971). Silica may be implicated in the aetiology of PMF, although this is still sub judice (Morgan and Lapp, 1976). The maximum pulmonary deposition of coal dust occurs when the particle size is between 0.5 and 6 microns (Davies, 1949) and close attention has been paid to dust sampling as a means of estimating exposure (Davies, 1952; Fay and Ashford, 1961; Oldham and Roach, 1952). Since 1975, airborne dust concentrations have been included in statutory requirements (Health and Safety Executive, 1976). The 1950's saw the beginning of large scale prevalence studies of pneumoconiosis in Britain with reports using different epidemiological techniques from Scotland (Black, 1953), Durham (McCallum, 1952; McCallum and Browne, 1955), Northumbria (McCallum and Newell, 1958), Wales (Cochrane and Thomas, 1965) and parts of Wales and England (Cochrane et al, 1956). The Pneumoconiosis Field Research, a major epidemiological study covering the whole country was set up in 1953 (Rogan, et al, 1966) and has studied the problem in great detail (Jacobsen, 1977). The annual number of new cases of pneumoconiosis for which claims were made over the last 15 years throughout Britain has remained between 2 and 3 per 1,000 men employed (National Coal Board, 1976), which in terms of men certified as having the disease has been around six hundred annually during this present decade (Health and Safety Executive, 1977). Over the last 20 years, however, there is some evidence that the point prevalence of pneumoconiosis has been falling for working miners of all ages X-rayed by the NCB radiological surveys (National Coal Board, 1976).

Mortality/

Mortality studies of miners and ex-miners with radiological pneumoconiosis have produced conflicting results. Cochrane et al (1964) reported on mortality among 6,474 Welsh coalminers and ex-miners followed up for six years. Those whose initial chest X-rays showed PMF had very high mortality and the Standardised Mortality Ratio (SMR) of those without pneumoconiosis was also raised. They found no relationship between SMR and X-ray category of simple pneumoconiosis, but did demonstrate that the SMR of ex-miners was significantly higher than that of miners. A subsequent follow-up of this same cohort 20 years after the initial medical survey (Cochrane, 1973) suggested that miners and ex-miners with B and C categories of PMF had reduced survival, but the survival rates for others were independent of X-ray category. However, these conclusions were challenged both on the specific grounds that Cochrane's figures did demonstrate reduced survival for men in category A in the 55 - 65 year age group (Curry, 1973) and on the general grounds that ventilatory impairment unrelated to X-ray categories would vitiate these conclusions (Davies, 1973; Campbell et al, 1973). Moreover all three critiques highlighted the point that quality of life had not been considered by Cochrane in his study. Cochrane and Moore (1978) in a follow-up of a random sample of 216 men aged 55 - 64 in 1956 living in an industrial town showed that those with simple pneumoconiosis survived as well as those with none. Jacobsen (1977) has studied the question of survival in greater detail by following up 17,000 miners throughout Britain for 14 to 18 years. His conclusions were that miners under the age of 35 with simple pneumoconiosis had lower survival rates than those without the disease,/...

disease, but that, in general, simple pneumoconiosis was not associated with increased mortality. In addition he found that miners with categories B or C PMF and those aged over 54 with category A, had higher death rates than those without pneumoconiosis.

Just as controversy has raged over the relationship between pneumoconiosis and mortality, so too has its relationship to morbidity. Higgins and Cochrane (1961) and Cochrane and Higgins (1961) found no evidence of an increase in respiratory symptoms or of decreased ventilatory function with increasing radiological grade of simple pneumoconiosis. Ryder et al (1970) and Lyons et al (1972 a) in autopsy studies of 247 deceased miners and ex-miners correlated post mortem findings with radiological categories and ventilatory capacity in life. Their conclusions in the latter investigation were that coalworkers' pneumoconiosis usually caused progressive impairment of ventilation, which in the simple type of disease was not related to radiological category. Their findings supported earlier work by Leathart (1959) that in such cases the presence of emphysema was a more important factor in determining the impairment of ventilation than the radiological category of simple pneumoconiosis. This study, however, was criticised by Oldham and Berry (1972) on the grounds that the miners studied were all deceased and hence unrepresentative of all miners. Fletcher (1972) and Higgins (1972) criticised the conclusions which they felt did not support their data. Lyons et al (1972 b) summed up by saying their findings supported the view that while nodular changes may correlate with radiology, destructive emphysematous ones did not, but did correlate with impaired/...

impaired pulmonary function. "Men dead from coalworkers' pneumoconiosis exhibit two pathological phenomena - coal nodulation and emphysema. Are these one disease or two?" they asked, and felt that a single explanation was more likely. Rogan et al (1973) conducted a long-term prospective study on 3,581 coalface workers in 20 collieries throughout Britain. They demonstrated a progressive reduction in the forced expiratory volume in 1 second with increasing cumulative exposure to airborne dust but could find no evidence that there was any additional effect on lung function associated with radiological changes characteristic of simple pneumoconiosis per se. They inferred from this that previously demonstrated associations were indirect expressions of the fact that radiologically-defined groups exhibit differences in their mean cumulative dust exposures, thus reflecting the relationship between such exposure and radiological state (Jacobsen et al, 1970). Cochrane (1976) marshalled evidence to support the premise that simple pneumoconiosis causes no disability and Lapp et al (1974) made great play on the semantic distinction between ventilatory impairment and disability. They were of the opinion that simple pneumoconiosis may cause respiratory impairment, i.e. abnormality of pulmonary function, but that this was insufficient to produce respiratory disability, i.e. inability to work. Davies (1974) drew attention to the difficulties in assessing disability in pneumoconiosis, with its medico-legal implications under the Industrial Injuries Act, and, at the same time, censured the Industrial Injuries Advisory Council for "the regular application of the rule that if the results of ventilatory tests are normal disability is not present and if they are abnormal this is due /...

due to something other than pneumoconiosis".

Whatever relationship exists between radiological classification of pneumoconiosis and the clinical state, there is enough evidence that coalminers have significantly more chronic obstructive lung disease (bronchitis and emphysema) than the general population, although even this has been challenged by Morgan (1974). The Medical Research Council (1966) acknowledged the high rate of bronchitis among miners but felt at the time that exposure to coal dust was less likely to be a causative factor than general social causes. Lowe and Khosla (1972), however, found more chronic bronchitis and poorer ventilatory capacity in 3,012 ex-coal miners working in the steel industry than among 9,361 steel workers of similar age and occupation who had never worked in mines. This relationship held irrespective of age and smoking habits. Generalisations from such a study must, nevertheless, be circumspect because of the possibility raised by the authors themselves, that their groups were selective since miners are known to leave the coal industry to take up other work because of their respiratory disability. Rogan et al (1973) were able to show a progressive reduction in $FEV_{1.0}$ with increasing cumulative exposure to airborne dust. Interestingly, they found in addition that increasing severity of bronchitic symptoms was associated with a loss in $FEV_{1.0}$ greater than that expected from the effects of dust exposure, smoking, age and physique. This suggested to them that once early bronchitic symptoms are present the disease may progress and ventilatory capacity may deteriorate independently of factors initiating the disease/...

disease process. Lamb (1976) studied 965 lungs collected from sequential autopsies and compared the lungs from coalminers with those of non-miners matched for age and smoking history. He found that centriacinar emphysema was present both in a higher proportion of miners and to a greater extent. The most recent data from the Registrar General (OPCS, 1978 a) confirm previous reports of higher death rates from obstructive lung disease among coalworkers. Jacobsen (1977) in his large scale epidemiological survey was able to show that even in those with no radiological pneumoconiosis increasing dust exposure among miners was associated with increasing mortality attributed to bronchitis and allied respiratory diseases. Neither, of course, was able to overcome the well-known problem of diagnostic inaccuracy at death certification, but the latter study was able to avoid previously noted difficulties associated with occupational classification.

Occupational lung disease among coalminers clearly presents a very intricate problem, with both simple pneumoconiosis and bronchitis related to each other and to other diseases in a highly complex way. It has even been suggested that the presence of chronic bronchitis may afford some protective action against the development of pneumoconiosis (Davies, 1974), although data from the Pneumoconiosis Field Research were unable to support this (Muir et al, 1977). What is clear is that progressive massive fibrosis is a major complication of simple pneumoconiosis (Cochrane and Carpenter, 1956; Cochrane, 1962) with serious implications for survival (Jacobsen, 1977) and there is a suggestion that progression may be adversely affected by gastric/...

gastric surgery (Phillips, 1970). Both forms of pneumoconiosis appear to predispose to tuberculosis (Rivers et al, 1957; Gordon, 1975; Sayed, 1975; Farer, 1976), and this again seems to be exacerbated by gastric surgery (Phillips, 1970). Right-sided cardiac hypertrophy has also been shown to be more common in coalworkers with pneumoconiosis, less common in the simple form, but frequent and to a considerable degree in the complicated variety (James and Thomas, 1956). The relationship between pneumoconiosis and mortality from coronary artery disease is even more problematic with opinion based on epidemiological studies claiming that coronary thrombosis is unlikely to prove more fatal in those with pneumoconiosis than in those without (Rooke et al, 1976; Parkes et al, 1976). This view has however been questioned on several grounds. Davies (1976) maintains that the epidemiological evidence does not support this conclusion, and that intuitively the opposite is more likely. Furthermore both he and Andrews (1976) highlight the inappropriate application of statistically derived conclusions from epidemiological surveys to individual patients.

It is clear that a mass of data has been accumulated on occupational lung disease among miners. Much of this has been essential to our understanding of the problem. On the other hand much of it has stemmed from an empiricist approach to a complex problem made even more difficult by medico-legal considerations.

3.4. 3. Other Diseases /

3.4. 3. Other Diseases

Considerable interest has been shown in lung cancer rates among miners ever since James (1955) compared his autopsy findings in 1,827 coalworkers with 1,531 non-coalworkers, and found that, at least in those cases coming for necropsy, lung cancer was found less frequently among the mining group. Smith (1959) in a highly selected group of 320 men with lung carcinoma treated surgically, found better survival in miners than in non-miners. In an investigation of mortality statistics and necropsy data from various sources, Goldman (1965) concluded that the death rate of coalminers from cancer of the lung is appreciably lower than the national rate for men of comparable age. He felt that it might be a consequence of the inhalation of coaldust as there appeared to be some evidence that death from lung cancer was lowest among miners whose exposure to coaldust was greatest. Ashley (1969 b) too noted that lung cancer in men was significantly lower in coalmining areas. He postulated that reduced lung cancer mortality may be related to an enhanced state of immunological preparedness in the lungs of people constantly exposed to dust. However, conflicting reports have appeared. Crofton (1969) found an excess mortality rate from lung cancer in males in coalmining areas in Scotland compared with non-mining areas. She found an excess hospital discharge rate paralleled this too, and drew attention to the fact that smoking habits among miners were not dissimilar from non-miners (Table 4), although more recently the Registrar General (OPCS, 1978 a) has suggested that a higher proportion of coalminers are current cigarette smokers than the/...

the general population when the results are age-standardised. He has estimated that the "proportional current smoking ratio" for underground coal mine-workers in 1972 was 131 with a figure of 160 for surface workers. Mooney (1975), too, in a review of 300 necropsies on miners over the age of 50 , all of whom had pneumoconiosis, found more deaths from carcinoma of the lung than would be expected by applying nationally based lung cancer death rates to the same group. However/

Table 4: Cigarette Consumption Among Miners and Non-Miners.

	Cigarette Smokers (%)	Cigarettes/ Week/Smoker
Scottish miners	80.1	106.5
British miners	52.5	104.5
All men, England & Wales	72	130
All men, Scotland	72	141

Source: Crofton (1969)

However, McLintock (1975) drew attention to the lack of individual smoking histories in Mooney's study and pointed out the danger in comparing results from a necropsy study with that obtained from death certification. Jacobsen (1977) found even more conflicting results. Overall he noted an eightfold excess of lung cancer deaths in smoking miners compared with non-smoking miners and half the number of/...

of deaths among those with categories 2 or 3 of simple pneumoconiosis or PMF, compared with men without pneumoconiosis. However, considerable regional variation was evident, with one Scottish colliery of the four in his study having twice the number of deaths expected and a similar excess among miners from one pit in an area covered by Mooney's (1975) report. One possible explanation is the existence of regional variability in the underground concentrations of radioactive airborne radon, a known cause of lung cancer, and there is some evidence that this may be a factor (Duggan et al, 1970).

Digestive organ neoplasia may be more common among coalminers. Ashley (1969 a) found a significantly increased SMR for stomach cancer in coalmining areas of Britain, and Jacobsen (1977) confirmed that simple pneumoconiosis and dust exposure were associated with excess cancers of the digestive system.

Rheumatism in coalminers has been investigated in some detail. Lawrence and Aitken-Swan (1952) compared their observations of rheumatic complaints among 1,742 miners from one pit with 1,931 non-miners. They concluded that the gross incidence of rheumatic complaints was similar in both groups but that miners experienced an earlier onset and lost more working time. It should be noted, however, that further scrutiny of their results reveals that they investigated not the incidence of rheumatic complaints but their period prevalence during 5 years. They found, nevertheless, that rheumatism, chiefly of low-back sciatic pain, was second only to chest conditions, as a cause of invalidity from the mines. Lumbar, sciatic and knee pains/...

pains were the principal rheumatic symptoms found. Two years later Kellgren and Lawrence (1952) conducted a thorough clinical and radiological investigation on a random sample of 84 miners and 87 non-miners from these same groups plus 24 miscellaneous workers. They noted significantly more radiological changes of lumbar disc degeneration and possibly more osteo-arthritis of the knees among miners than either manual or office workers, and a significant association between these radiological changes and attacks of lumbar-sciatic and knee pain. Miners, too, showed more arthritic changes in other joints such as the elbows and hips. On the basis of their inability to prove an association between complaint of pain and "relative emotional stability", Kellgren and Laurence concluded that degenerative joint changes were mainly responsible for the disabling lumbar-sciatic and knee pain, which Laurence and Aitken-Swan (1952) had previously found to be more prevalent amongst miners than the general population. To investigate further the occupational factors involved, Lawrence (1955) studied rheumatism among miners, dockers, light manual and office workers. His main conclusion was that there was a high incidence of degenerative changes in the lower dorsal and lumbar intervertebral discs in coalminers, a high proportion of whom lost work because of corresponding lumbar and sciatic pain. In more detail he found that although a high proportion of dockers had disc degeneration, it was even higher among coalminers, in whom it was closely related to back injuries and duration of heavy lifting. Miners working in wet conditions had more low back pain, lost more work, and were more likely to have some X-ray evidence of disc degeneration. Miners who stooped also had more pain and/...

and more incapacity but no more X-ray changes. He also observed that osteo-arthritis of the knees was most common in underground roadway workers, where it was related to injury but not to kneeling, height of seam, distance walked or heavy lifting. Wet conditions caused more incapacity from this cause but had no apparent additional effect on X-ray changes. Furthermore, Laurence noted that osteo-arthritis of the elbow, wrist and hand was more common among miners. Prescribed diseases other than pneumoconiosis and silicosis include the "beats", tenosynovitis of the wrist, dermatitis and nystagmus. The numbers of new spells of benefit for all these conditions have fallen over the last 15 years (Table 5).

Table 5: Yearly Average Number of New Spells of Prescribed Disease other than Pneumoconiosis, 1959 - 76.

	1959-63	1964-68	1969-73	1974-76
Beat knee	6,175	3,407	1,043	460
Beat elbow, hand and tenosynovitis	1,278	761	313	179
Dermatitis	3,027	2,264	1,346	823
Nystagmus	50	18	4	2

Source: NCB (1976) and HSE (1977)

This fall is not obscured by the fact that less men are now employed in the industry as the average rate per 1,000 men employed has also/...

also fallen (Table 6).

Table 6: Yearly Average Number of New Spells of Prescribed Diseases other than Pneumoconiosis, per 1,000 Men Employed, 1959 - 76.

	1959-63	1964-68	1969-73	1974-76
Beat knee	10.63	7.94	3.69	1.79
Beat elbow, hand and tenosynovitis	2.20	1.77	1.11	0.70
Dermatitis	5.21	5.28	4.76	3.20
Nystagmus	0.09	0.04	0.01	0.01

Source: NCB (1976) and HSE (1977)

It should be noted that these tables refer only to successful claims for benefit under the National Insurance (Industrial Injuries Act), and therefore, in all probability under-estimate the actual incidence of these conditions.

The beats exist in three forms: beat hand is a subcutaneous cellulitis of the hand, and beat knee or beat elbow is a subcutaneous cellulitis or acute bursitis arising at or about the knee or elbow. Many are infective in origin, frequently arising from infected hair follicles (Atkins and Marks, 1952). In these cases staphylococci are important pathogens (Atkins and Marks, 1952; Roantree, 1957). However,/...

However, non-infective simple bursitis is more common (Watkins et al, 1958) although Sharrard (1963) found a high proportion of the latter contain blood. Both these authors stress the importance of localised pressure and trauma as the principal cause, and emphasise the necessity for better knee pads to reduce the incidence of beat knee. Dermatitis in coalminers has been reviewed by Rook and Hodgson (1956) and investigated too by Edmonds (1958) and Matthews, (1959). Both occupationally induced and non-occupationally induced dermatitis are common in miners, especially among face-workers. Oils, hydraulic fluid, coal by-products and other chemicals have all been incriminated as causes and the NCB believes that the environmental conditions of British mines add to the difficulties of eradication (NCB, 1976). Hot, humid and dusty atmospheres combine with relatively low seams to exacerbate the problem. Other skin diseases are of importance in mining too. Furuncles are common and in the past at least have been responsible for considerable loss of work (Edmonds et al, 1954). Foot ringworm is common among miners and communal bathing at the end of the shift is important in its spread (Gentles and Holmes, 1957).

Emotional stability in colliery workers has attracted attention. Heron and Braithwaite (1953) investigated 177 miners and found a gradation in the percentage labelled as "relatively unstable", with more men classified in this category among those who worked underground (Table 7). They considered that the most likely explanation was that " underground work constituted a sufficient stress to affect the stability of those who in less stressful/...

stressful circumstances would have remained relatively unaffected".

Table 7: Emotional Stability in 177 Coalminers Working in Different Areas of the mine.

	Number Examined	% Labelled "Relatively Unstable"
Sedentary miners	37	33
Manual surface workers	42	45
Workers on surface and underground	23	52
Underground workers	75	61

Source: Heron and Braithwaite (1953)

Lion (1958, 1960) investigated the problem too. She found that miners with nystagmus scored more neurotic responses on testing than miners without nystagmus. This latter condition is a rarity nowadays in modern mines where good lighting prevails, and the relevance of her observations is unclear. She did find however that miners were less emotionally stable than railway workers and attributed this to the environmental stresses of mining.

Leptospiral jaundice used to be a problem at one time among miners but is probably not today. However one serological survey of a Scottish pit some 20 years ago detected previously unrecognised infection in 2 out of 201 men tested (Adam and Edmonds, 1955).

Noise/

Noise-induced hearing loss had received comparatively little attention. Dick (1972) found no evidence of severe hearing loss after performing 400 audiograms on underground miners in the UK although there is evidence from overseas that hearing loss does occur (Lancet, 1972).

Increasingly, coalmining is becoming more mechanised, and as this continues, health problems previously unrecognised in mining are likely to assume importance. New chemicals, including oils and industrial solvents have been introduced in recent years, and health problems associated with their use and already recognised in other industries may add to those well-recognised as specific to mining today.

3.4. 4. Discussion

It is apparent that the approaches adopted by most workers to the health implications of coalmining differ strikingly from that advocated in the previous chapter. It has already been suggested that their largely empiricist approach has arisen partly because the complex issues involved have been obfuscated by medico-legal considerations. Notwithstanding the vast amount of energy which has been devoted to the subject, I would contend that much of it has nevertheless been misdirected and, as such, has failed in many ways to come to terms with the overall health implications of coalmining to the men themselves, to their families, and to the communities in which they live. Although various disease conditions, for example, have been studied in detail, scant attention has been devoted to/...

to the consequences of these in functional and social terms on the lives of the men involved. In instances where these have been examined, a piece-meal outlook has generally prevailed resulting in only one, or perhaps a few conditions being investigated at any one time. As noted previously, the health services have been largely ignored, and the notion that dialogue with coalmining communities should form a cornerstone of our approach to health has not even entered into consideration.

The following chapters of this thesis outline my attempt to come to terms with these omissions, and to utilise the WHO definition in a practical situation for the investigation of the health of a mining community in West Fife.

4. Design and Methods for an Investigation into the Health and Health Needs of a Mining Community in Fife.

The specific aim of this enquiry was to follow-up a cohort of men who worked at the same coalmine in Fife in 1955 to ascertain the effect of their mining experience on their health.

For reasons already outlined in the introductory chapter the model of health for this study is that of the WHO (1946), and its measurement is broadly based on the principles laid out in the WHO (1960) study of local health services. Both approaches suggested by the latter report have been included, namely an account of the health service facilities in the locality within a framework of the general social and economic situation, and interviews with survivors of the cohort of miners still resident there to determine their health status and the extent to which the services provided are relevant to their needs and wants.

4.1. Method of Documenting Local Health Service Provision

Sources of information about local health services have been two-fold. Firstly, official documents, including annual reports where available, provide background knowledge about the services. Secondly, I have adopted an ethnographic or ethnoscience approach to augment this basic information. This technique involves a "systematic and descriptive documentary study of phenomena through the eyes, ears and thoughts of the people in their situation" (Leininger, 1969). By becoming involved in different aspects of the health services in Fife, by talking with professionals at all levels of health care/...

care delivery throughout many branches of the health services, by observing (where possible) these services in action over a period of two years, and by complementing this by discussions with patients, potential patients and other recipients of health care, I have been afforded a unique opportunity to study concrete situations in Fife, from the viewpoint of both givers and recipients of health care.

It soon became apparent to me that many organisations which are concerned with the health of the community are not specifically organised to deal with health matters. I have excluded these organisations from the scope of my enquiry and concentrated only on those for which health is a prime objective, since it seemed inappropriate to measure the achievements of these bodies by the yardstick of health when this was merely a by-product of some other function. In some cases their contribution to health is enormous, perhaps even greater overall than that of the National Health Service, but it remains nevertheless a spin-off rather than an objective. Housing authorities could certainly be included in this category. Their major role in the improvement of the health of the population is well-documented. Yet it remains that people do not seek better housing in the expectation that their health will improve as a consequence. Rather they do so because they prefer to live in more congenial surroundings, and the function of housing authorities is to satisfy this desire for more pleasant living conditions and not primarily to improve the health of the residents. That it may do so is but an added bonus. The police, fire, education and consumer protection services all make some contribution to society's health/...

health as important by-products of their main function, and they and others with similar roles have been excluded for the same reasons.

It should be re-emphasised that my aim here was to document the available facilities and describe the activities of a group of bodies whose principal aim is to provide some aspect of health care to the central Fife community from which the Nellie cohort of coalworkers has been drawn.

4.2. Method of Determining the Health of the Cohort of Miners

4.2. 1. The Origin of the Cohort

As already noted in the introduction, this cohort comprises those men whose names and dates of birth appeared on the colliery delegate's union list of employees at the Nellie Pit, Lochgelly, in 1955. It included coalminers, tradesmen and other pit employees. The list consisted of fifteen type-written sheets of names of employees, their dates of birth and their check numbers. As all mine employees must be members of one of the four trade unions, the list was probably comprehensive and represents a census of employees at the pit. However the list was not a reference document but a worksheet on which records of new employees, men leaving the pits and men dying were made in ink and pencil by the mine delegate. As a consequence of its use, some of the sheets were torn and some parts missing. In all, 431 names were decipherable from the original list, although it is apparent from torn fragments of some sheets that another 12 names at least, and probably more, have been lost.

Another/

Another problem with the list is that the exact date of compilation is unknown as it is undated. However the mine delegate affirms that it was made up in September or October, 1955, and there is independent information to back this up. Firstly, all migrations into and out of the pit are recorded on the sheets and these are dated. The first entry added to the list was on 8/10/55 and the last one on 10/12/56, with nearly all weeks between these two dates represented. Secondly, during subsequent interviews with the men themselves, I learned that several of them entered mining in the Nellie Pit in 1955. The latest recorded date of commencement at the Nellie for an interviewee was in August, 1955. It is apparent then that the list of employees was compiled after August but before the 8th October of that year. In accordance with these findings I have assigned a putative date for compilation of the list of the 1st October, 1955.

4.2. 2. <u>The Follow-Up Procedure and Results</u>

Of the 431 names on the list, 4 were eliminated: one was a female who worked at the "pit-head"; in two cases no forename or initial was available and this made tracing virtually impossible; the last case was an elderly man who was known, and later confirmed, to have died well over a year before the list could possibly have been compiled. Bearing in mind that the sheets were probably typed by a clerk working from a colliery ledger, and that the purpose was connected with union affairs and not of financial concern to the colliery, it is not surprising that the name of someone deceased was inadvertently included in this enumeration.

The/

The Nellie cohort thus consists of the remaining 427 men, all employed at the Nellie Pit, Lochgelly, on the 1st October, 1955.

The indentification information available for this cohort was surnames and dates of birth. Full forenames were rarely available. A few had initials only and in the rest, abbreviated forenames were known. This information was transferred onto record cards, one for each man, and additional information included as it became available. The 30th September, 1977, was chosen arbitrarily as the end-point of the study, and an attempt was made to ascertain each man's vital status and whereabouts on that date. The follow-up period was thus 22 years.

The first step in the follow-up involved the Primary Care Division of Fife Area Health Board (AHB) which confirmed that 235 of the men were still resident in Fife and supplied me with their last known addresses and the names of their family doctors.

Since 1974, a computerised record of all deaths registered in Fife has been forwarded to the AHB from the General Register Office (GRO). A check on this confirmed that 17 had died in this four year period. Death certificate (DC) details were noted, including date and cause of death and the occupation of the deceased.

The names of the remaining 175 untraced men were forwarded to the National Health Service Central Registry (NHSCR) in Scotland which advised me of the whereabouts of 70 men and provided DC details on another 78. They were unable to trace 27. This information was/...

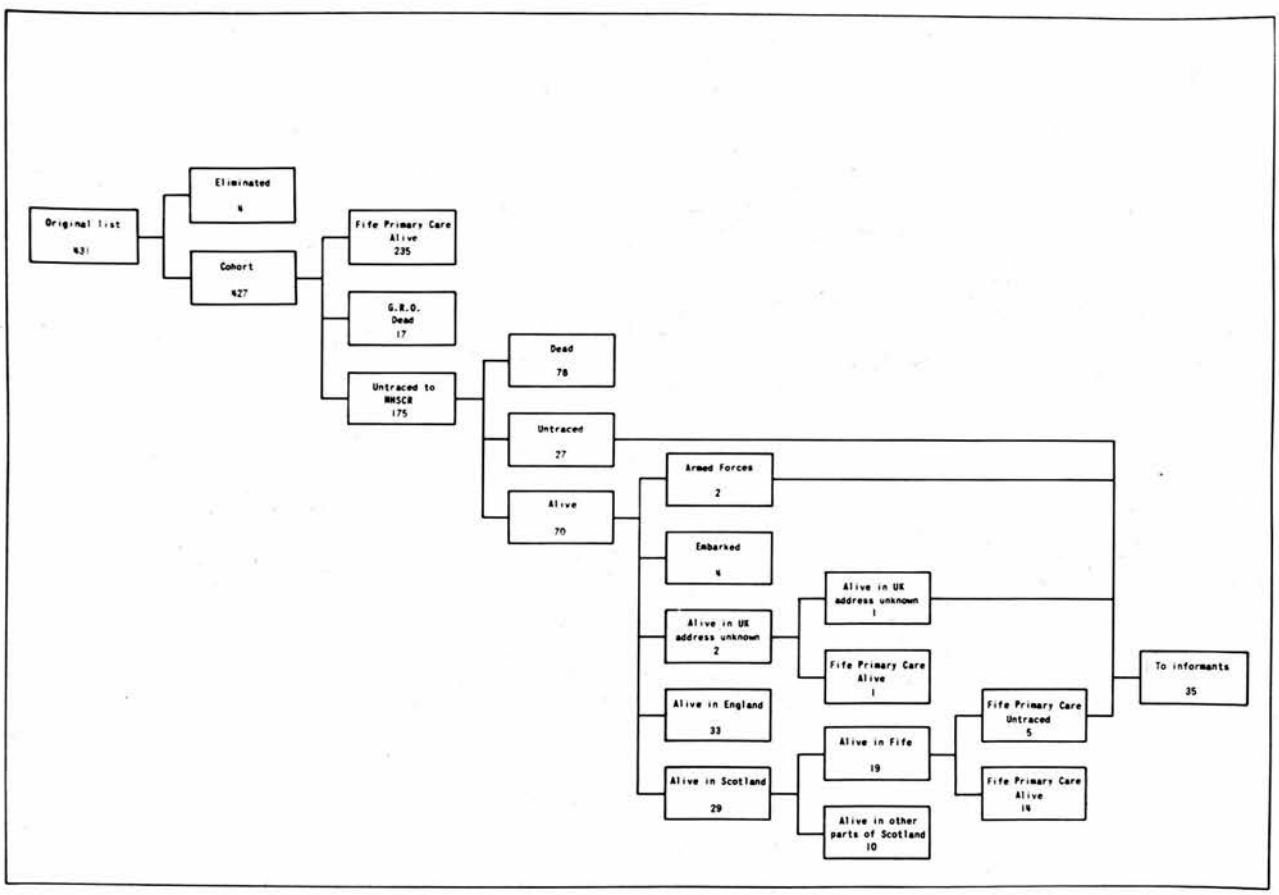
was supplied to me in late August, 1977. There is, however, a well-known variable delay of up to several months before the NHSCR is notified of deaths and migrations. For follow-up purposes I have assumed that this information reflected the vital status of these men on the 1st August, 1977.

The next stage in the follow-up procedure involved further investigation of the 70 men the NHSCR notified me as being alive. Two were said to be alive and serving in the armed forces; 4 had embarked on known dates overseas; 33 were alive and registered with the NHS in England; 29 were alive in Scotland, and 2 were alive in the UK but their exact location was unknown. Of the 29 said to be alive in Scotland, 19 were thought to be resident in Fife. When the names of these 19 and those of the 2 whose locations were unknown were again checked with the Primary Care Division of Fife AHB, 14 of the former group and 1 of the latter were confirmed to be alive in Fife. At the end of this stage, the NHS resources available to trace these men were exhausted, yet 35 (8%) men remained whose exact whereabouts were unknown. These comprised 27 untraced by the NHSCR, 2 in the armed forces, 1 said to be alive somewhere in the UK and 5 untraced by the Primary Care Division of Fife AHB (Figure 3).

At this point it was anticipated that, as part of assessing their current health status, some of the miners in the cohort would be interviewed. It was resolved therefore to use the opportunity of the interview to enquire about the whereabouts of these 35 men in the belief that some of the informants would know what had become/...

become of their former Nellie colleagues. The/...

Figure 3: Follow-Up Procedure and Results of Cohort of ex-Nellie Coalworkers.



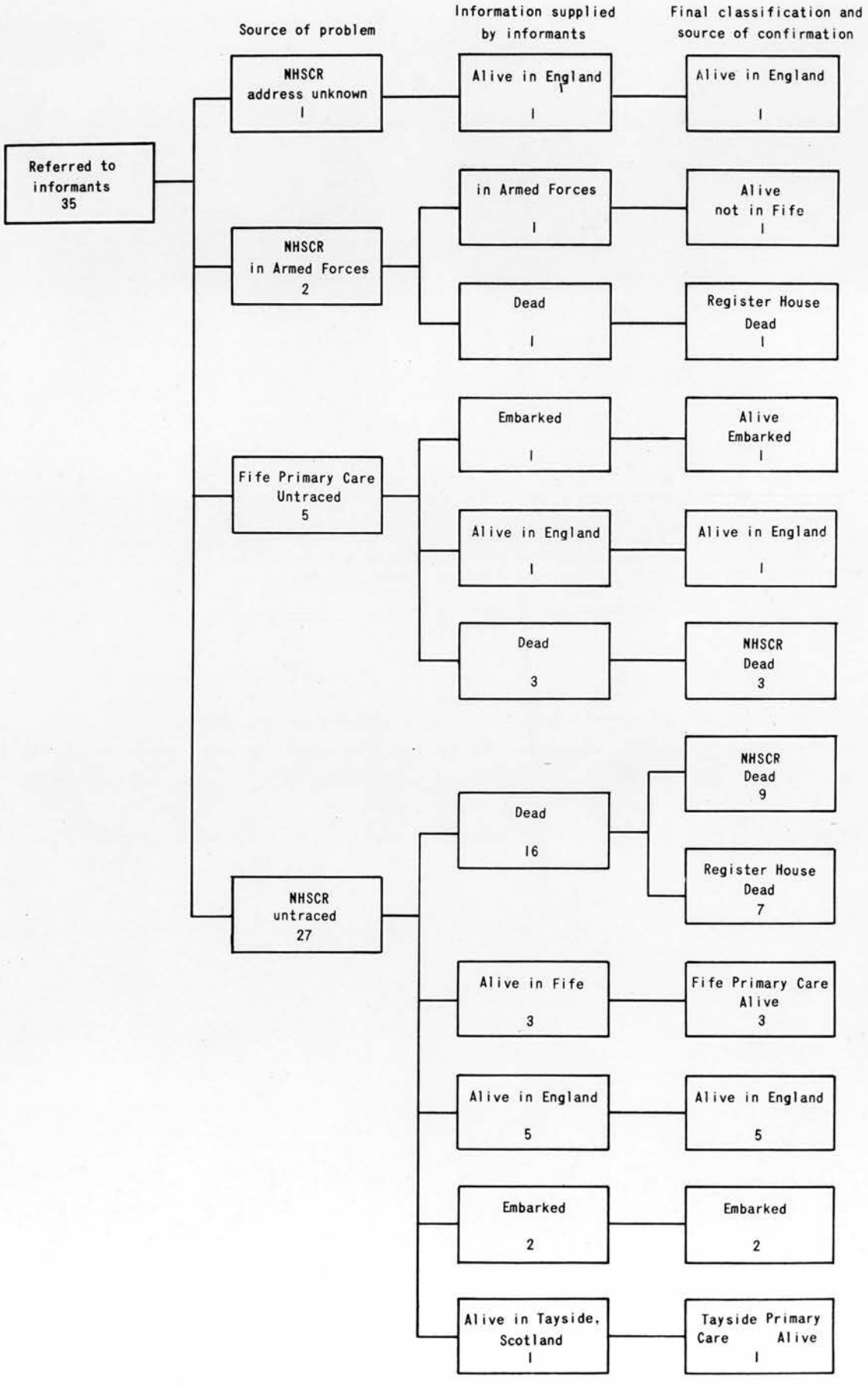
The informants believed that 20 of the 35 were dead and this was confirmed by examination of the DCs in all cases, through the NHSCR for 12 and through the register of deaths at Register House, Edinburgh for the other 8. In many cases the task was made easy by informants knowing not only the circumstances and place of death, even when this occurred in other parts of Britain, but also the deceased's address and exact date of death. Informants gave me the addresses of a further 3 men living in Fife and another living in an adjoining Health Board area, and this was confirmed by the respective Primary Care Divisions of the AHB.

In the other 11 cases, it was possible to gain some information about them, although it was not possible to confirm this through official sources in the same way as all the deaths were confirmed. The man in the armed forces was said to be still serving in the services, 3 were said to have gone overseas and 7 were said to be alive in England (Figure 4). For follow-up purposes this is assumed to be their vital status on 30th September, 1977. The vital status of the 427 men in the cohort at this stage, using all this information is shown in Figure 5. At a later date during interviewing it was learned that 2 men still registered with GPs in Fife were no longer resident there.

4.2. 3. Variation in Follow-Up Period

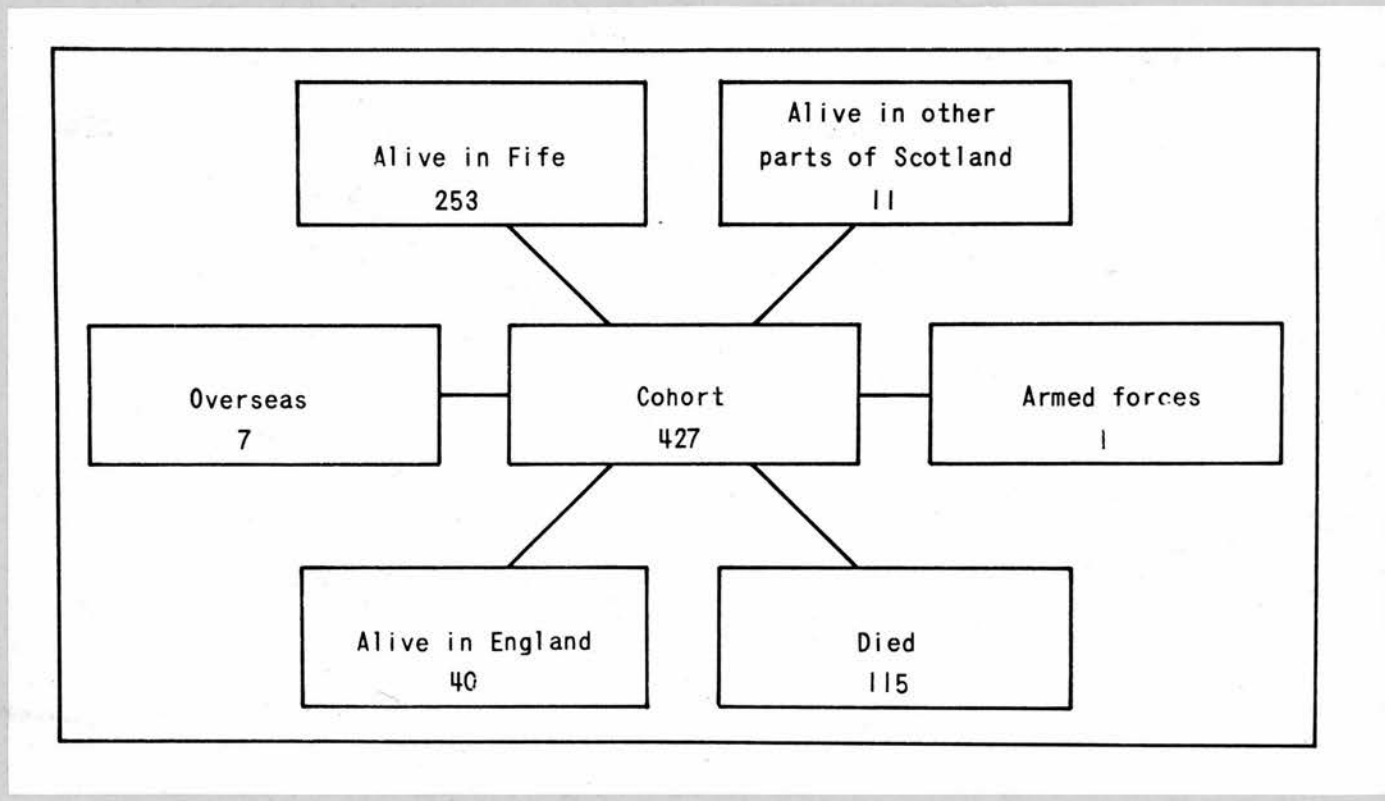
Although it was hoped to ascertain the vital status of the men on a specific date (30th September, 1977) this was only possible in the cases of the 115 who had died prior to that date, the 253 alive in Fife, and 1 alive in Tayside, on that date. In the case of information from the NHSCR the date applicable was the 1st August, 1977, and on/...

Figure 4 : Outcome of referring 35 ex-Nellie coalworkers to informants.



on that date 33 were alive in England, 10 in other parts of Scotland and 1 in the armed forces. In/

Figure 5: Vital Status of Cohort of 427 ex-Nellie Coalworkers.



In the case of 4 notified by the NHSCR as having embarked overseas prior to that date, the follow-up period has been assumed to be the date of embarkation. In the other 10 cases, informants thought 7 were alive in England and 3 overseas on the 30th September, 1977, and this follow-up date has been applied to this group.

4.2. 4. Validity of Follow-Up Data

Using a combination of information from recognised sources, namely the NHSCR, the GRO, Register House and the Primary Care Division of the AHB, and also from the mineworkers themselves, it has been possible to categorise all 427 men in the cohort.

In order to comment on the reliability of this categorisation it is necessary to make certain assumptions. Firstly, I have assumed that all those on whom I obtained a DC showing the same name and date of birth or age had in fact died and that that DC applied to that person, and not to another of the same name. Secondly, I have assumed that all those said to be living in Fife and in other parts of the UK by the NHSCR and by the Primary Care Divisions were indeed alive as stated. Unfortunately I have no means of checking my first assumption on the validity of death certification. Although most of that information was supplied to me by the NHSCR, I did examine personally the original DCs of all those 112 whose deaths were registered in Scotland and was unable to detect any which I thought might be referring to a different person. This, of course, is no proof that errors were not made. Equally I was unable to confirm whether those said to be alive in other parts of the UK were/...

were living there. However, it should be noted that the NHSCR recorded 19 of these sent to them as being alive in Fife, when in fact, 3 are definitely known to have died and 2 had left Fife to live elsewhere. Similarly 1 said to be in the armed forces had died. In a subsequent questionnaire study of 68 of the men said by the Primary Care Division of Fife AHB to be alive in Fife, I was able to interview personally 66 of them and confirm in the other 2 cases from close relatives that although alive and still registered with Fife GPs, they were now living and working elsewhere.

Assuming that all the unchecked information derived from NHS sources is accurate, we can be certain of the vital status on the 1st August or 30th September, 1977 of 115 who were deceased, 253 said to be living in Fife, 11 in other parts of Scotland, 1 in the armed forces and 34 living in England, making 414 (97.0%) in all. If in our follow-up study we include those who have gone overseas to the date of their embarkation recorded by the NHSCR, our follow-up is then 418 (97.9%).

No attempt was made to check the information supplied by the mineworkers on those who had moved overseas or to other parts of the UK. In no case, however, was any man's whereabouts accepted without at least 2 confirmatory accounts. In several cases it was possible to learn where these men were by speaking to their close relatives or personal friends. It is also clear that the completeness of follow-up would have been considerably less had I not utilised this source of information: the 27 untraced by the NHSCR and the 5/...

5 untraced by the Fife Primary Care Division would have been lost to follow-up. Yet I was able to learn and confirm that 19 of these 32 had died, 3 were alive in Fife and 1 alive in Tayside. Without this we would have been able to classify as "vital status certain" 391 (91.6%) excluding those who embarked, or 395 (92.5%) including to their date of embarkation, those who had left for overseas.

4.2. 5. The Sampling Technique

One problem which arises out of a cohort study such as this into the present health status of a group of coalworkers is that it is difficult to make generalisations, both because of the age structure of the cohort and because of differential migration out of the industry. It has already been noted that any group of working miners, as the Nellie cohort was in 1955, inevitably only includes those who have survived in the industry. One method of allowing for the effects of age and for diminishing the effects of migration is to stratify the cohort by age.

On the basis that all teenagers in the Nellie in 1955 must have been fairly new recruits to the industry, I stratified the cohort according to whether they were born before or after 1st January, 1936. All those born after that date are classified as "recruits"; those born before that date are "non-recruits". Recruits would therefore be aged less than 19 years 9 months on the 1st October, 1955. Unfortunately even teenagers migrate out of the mining industry, so this stratification only minimises the difficulties; it does not remove them entirely. The vital status of the recruits is shown/...

shown in Figure 6 and of the non-recruits in Figure 7.

Figure 6: Vital Status of Cohort Recruits.

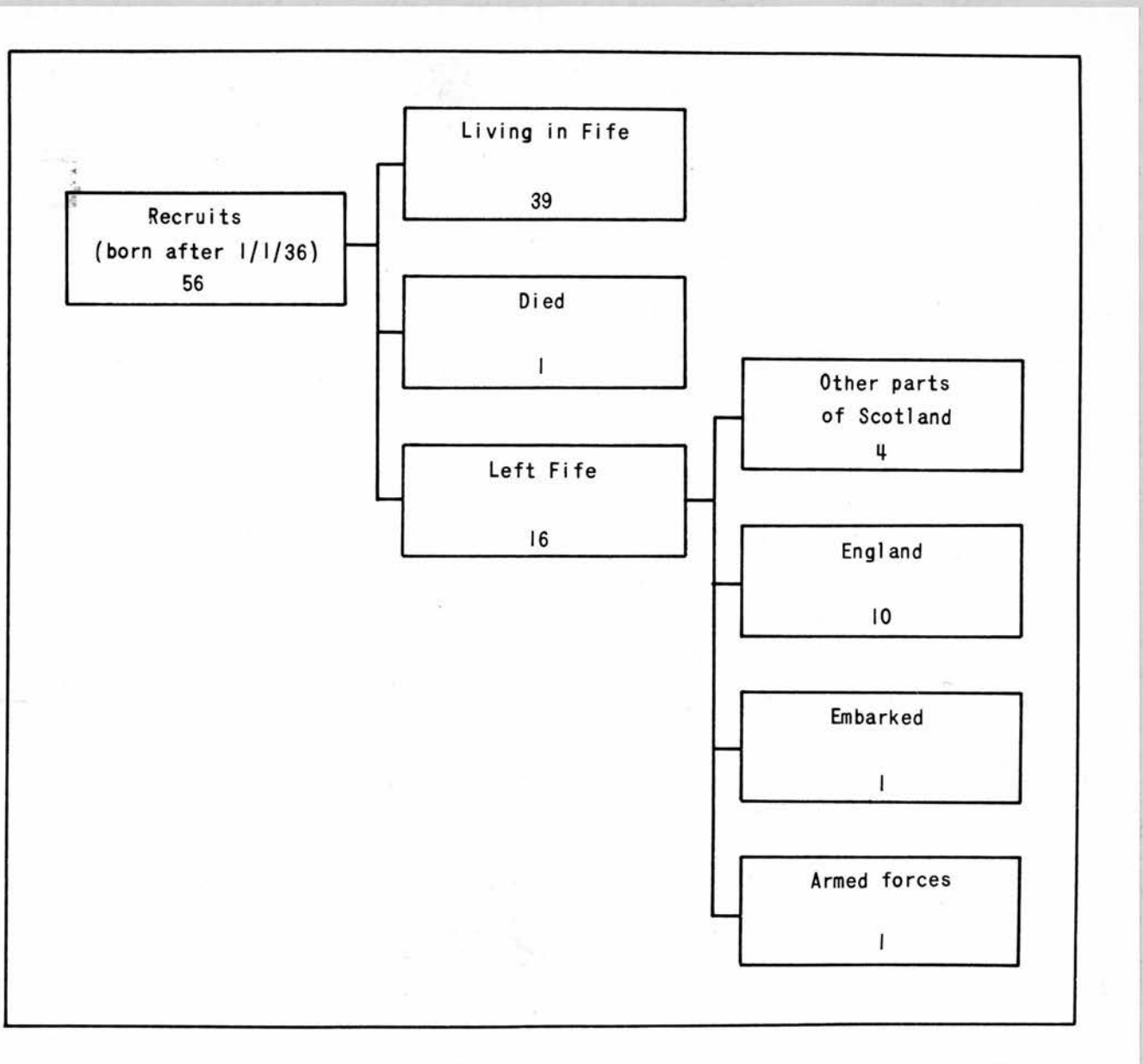
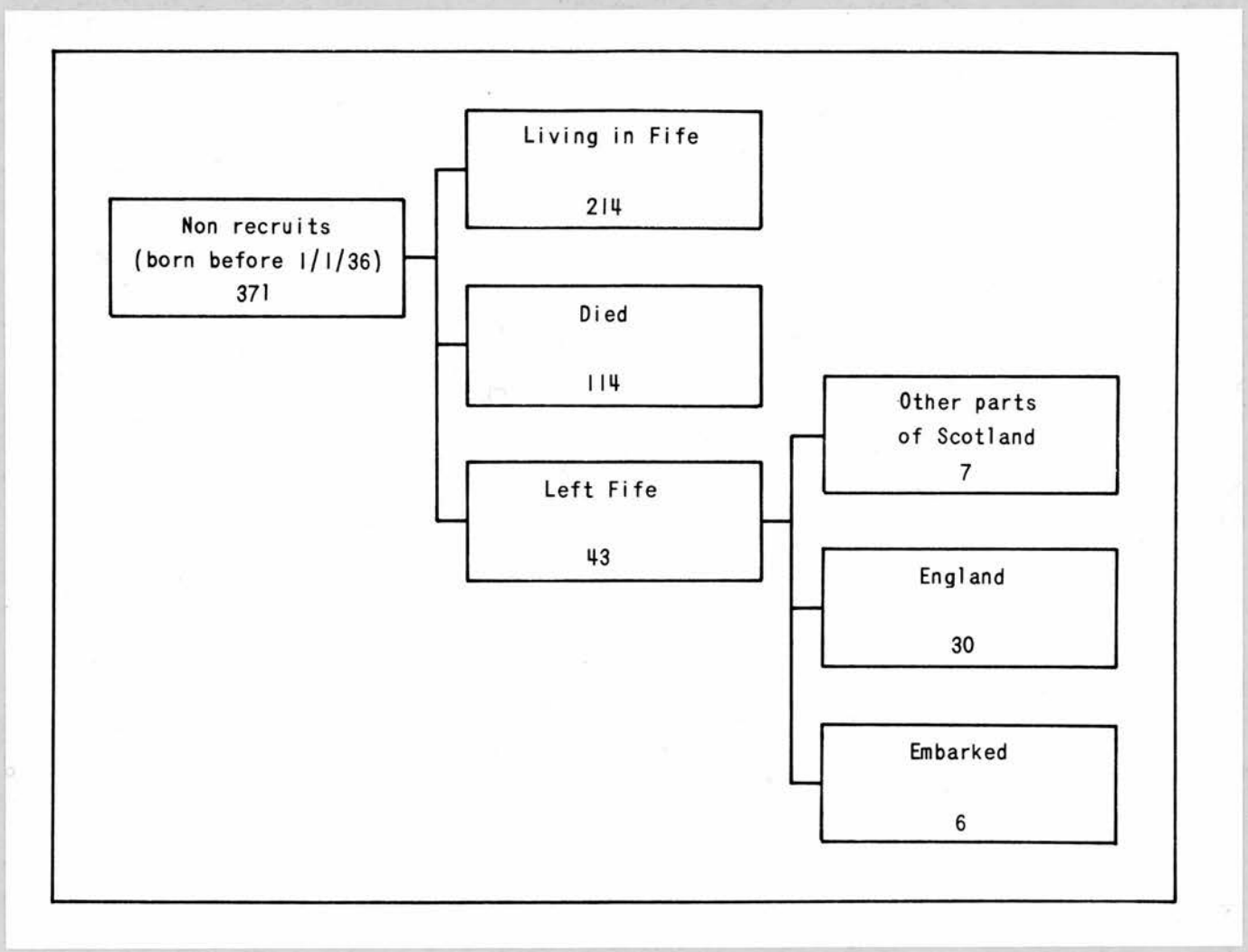


Figure 7: Vital Status of Cohort Non-Recruits.



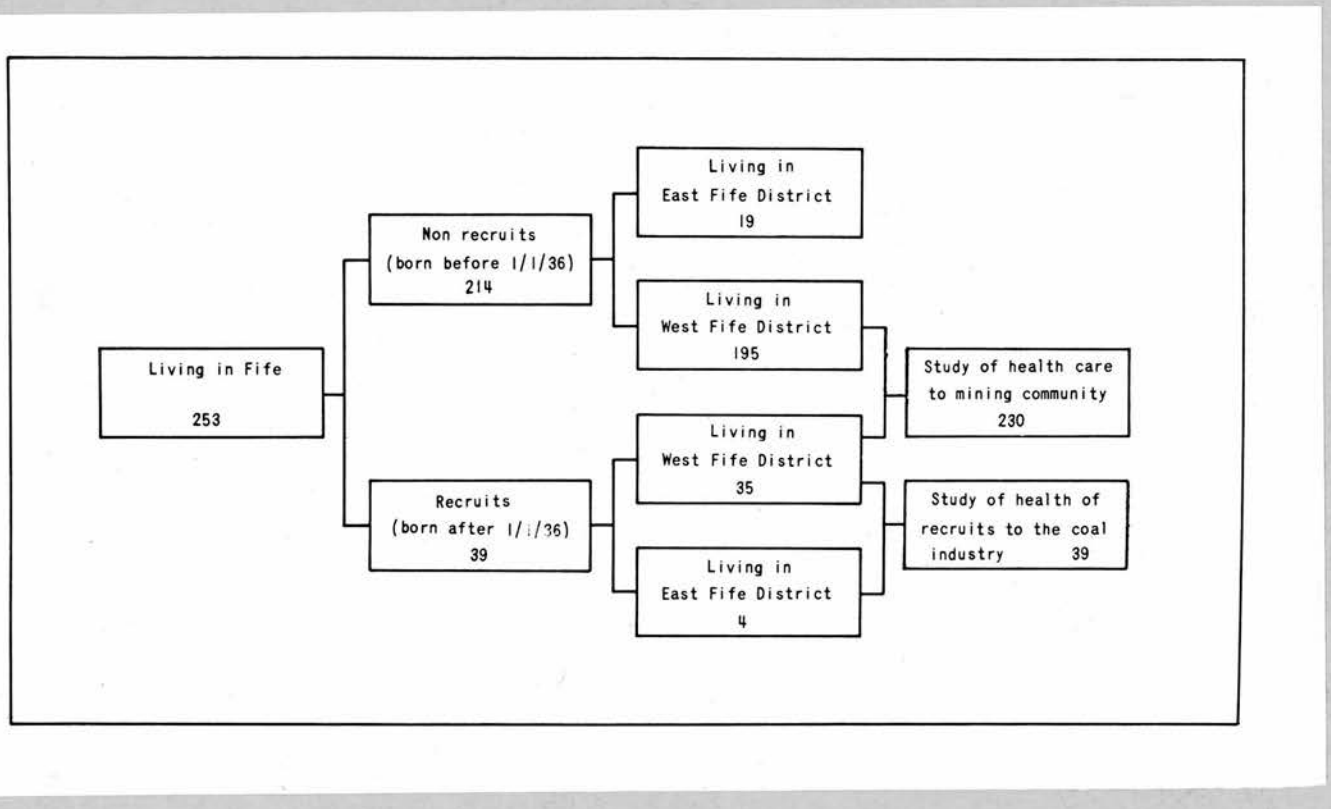
Two features were apparent at this point. Firstly, many of these ex-Nellie workers, although resident somewhere in Fife, were no longer living in the part of West Fife District of Fife Area Health Board of which the Nellie community was a part. Secondly, there were obviously insufficient resources available for me to interview any workers resident outwith Fife, and even those still living in Fife were too many to be covered by a census technique. I decided, therefore, to stratify the cohort again according to whether they were resident in West Fife District or not, and to use sampling methods to reduce the workload involved in interviewing. It was hoped that this would ensure adequate cover to permit conclusions to be drawn.

It seemed, therefore, that there existed two problems to which answers were being sought. One was specific in nature, dealing with the health status of those ex-Nellie workers still living in West Fife in relation to the provision of health services in the area. The other was more general in nature, dealing with the subsequent health of new teenage recruits into mining. Figure 8 illustrates this graphically and shows the corresponding sampling frames.

Because only 39 recruits out of a total of 56 were said to be living in Fife, I realised that, to make any generalisations, it would be necessary to attempt to interview all of them. Furthermore, I felt that the maximum number of interviews overall which I could reasonably manage was around 60. However, there was clearly a difficulty in determining the most appropriate number of non-recruits/...

non-recruits to interview when I had little to guide me from previous work about the likelihood of various responses, and hence had no indication of what the standard errors might be. The/

Figure 8: Area of Residence in Fife of Recruits and Non-Recruits.



The problem involved the calculation of sample size for a stratified simple random sample:

Let N = the universe population (230)

N_h = the population of the h^{th} stratum ($N_1 = 195$; $N_2 = 35$)

n_h = the sample population of the h^{th} stratum (n_1 is unknown; $n_2 = 35$)

P_h = the proportion of the population of the h^{th} stratum with a given attribute

V_P = the variance in the universe population.

Applying a finite correction factor for stratified simple random sampling without replacement:

$$V_P = \frac{1}{N^2} \sum \frac{N_h^2 P_h (1 - P_h) (N_h - n_h)}{n_h \quad (N_h - 1)} \qquad (1)$$

Now, in our sample, we have two strata, in the second of which $N_h = n_h = 35$.

Hence,

$$V_P = \frac{N_1^2 P_1 (1 - P_1) (N_1 - n_1)}{N^2 \quad n_1 \quad (N_1 - 1)} \qquad (2)$$

and/

and,

$$V_P N^2 (N_1 - 1) n_1 = N_1^3 P_1 (1 - P_1) - N_1^2 P_1 (1 - P_1) n_1 \qquad (3)$$

Therefore,

$$n_1 = \frac{N_1^3 P_1 (1 - P_1)}{N_1^2 P_1 (1 - P_1) + N^2 (N_1 - 1) V_P} \qquad (4)$$

Now P_1 is unknown, but the variance V_P is maximum when $P_1 (1 - P_1)$ is maximum (2), and from elementary calculus this occurs when $P_1 = 0.5$. Hence the maximum sample size required for a given variance will occur when the probability is 0.5. Any other level of probability in a given sample will reduce the variance.

Let $P_1 = 0.5$

Then $$n_1 = \frac{195^3 \times 0.5^2}{(195^2 \times 0.5^2) + (230^2 \times 194\ V_P)} \qquad (5)$$

$$= \frac{1,853,717.5}{9,506.25 + 10,262,600\ V_P} \qquad (6)$$

Let $V_P = 0.01$, i.e. standard error (SE) = 10%

Then $n_1 = 17$ (7)

Let $V_P = 0.0025$, i.e. SE = 5%

Then $n_1 = 53$ (8)

Let $V_P = 0.0064$, i.e. SE = 8%

Then $n_1 = 25$ (9)

Now/

Now resources were more than adequate to cope with 17 interviews but not enough to cope with 53 from this group. A compromise of 25 was reached, and this entails a maximum standard error of 8%. The response rate in the General Household Surveys in Scotland is approximately 85%. In anticipation of a similar response the sample n_1 was therefore increased to 29 to ensure 25 successful interviews. The finallist of men to be visited and interviewed therefore comprised all 4 recruits said to be living in East Fife District, all 35 recruits in West Fife, and a simple random sample of 29 of the 195 non-recruits from West Fife, making a total of 68 men in all. With an estimated overall response rate of around 85% it was hoped, therefore, to complete around 58 interviews.

4.2. 6. The Questionnaire

Because the interviewing was to be done by myself alone, it was felt that the questionnaire relating to these ex-coalworkers' health could be less restrictive than those used by non-medical interviews in sociological and market research. A structured questionnaire was therefore devised containing questions, some of the answers to which could be coded, with others open-ended and narrative. The questionnaire was not pre-coded as it was hoped to code some of the responses to the open-ended questions after completion of the interviewing. Once the interviews were over, appropriate replies were coded. IBM-80 cards were then punched and sorted on a Hollerith machine in preparation for analysis.

It was appreciated there were other advantages in conducting/...

conducting interviews entirely on my own: the various terms and definitions used could be applied with consistency; resources did not need to be expended on training interviewers; the number and type of questions asked and the time spent on each interview would not require to be restricted to the same degree that would be essential using non-medical interviewers. Indeed, I felt that many men would wish to take advantage of the situation to discuss their medical history with an "independent" doctor in their own homes, and that a comprehensive questionnaire would be advantageous not only to the results of the survey but to the interview-situation itself. Many sources were consulted prior to drawing up a provisional questionnaire with the final questions based principally on the General Household Survey (CSO, 1977), Kohn and White (1976), Dunnell and Cartwright (1972) and Jacobsen (1977). Topics covered included employment history, symptomatic health, use of primary care, general, hospital and other health services, household composition, housing and economic level. Two other sections were included. One has already been alluded to in a previous section; the tracing of the 35 workers whose whereabouts were not known to the health services.

The other section was one on "functional health", designed to determine the interaction between a person's symptomatic health and his perceived ability to function in society. The definitions and scales for the classification of function levels were derived from Patrick et al (1973 a), who divided functional health into three scales, a social activity scale, a mobility scale, and a physical activity scale. These scales and definitions are shown in Figure 9.

Figure 9: Scales and Definitions for the Classification of Functional Health Levels.

SOCIAL ACTIVITY SCALE

Scale	Step	Definition
A	Performed major and other activities	Major means specifically work if below retirement age or maintenance of household if retired. Other means all activities not classified as major such as clubs, shopping, hobbies or games.
B	Performed major activity but limited in other activities	Worked or kept house but limited in other activities.
C	Performed major activities with limitations	Limited in the amount or kind of major activity performed, e.g. needed special rest periods or working aids.
D	Did not perform major activity but performed self-care activities	Did not work or keep house but dressed, bathed and fed self.
E	Required assistance with self-care activities	Required human help with dressing, bathing or eating and did not perform major or other activities.

MOBILITY/

MOBILITY SCALE

Scale	Step	Definition
A	Travelled freely	Used public transport or drove alone.
B	Travelled with difficulty	Went outside alone but had trouble getting around the community freely or required assistance to use public transport or drive.
C	In house	In house all day because of health, or needed human help to go outside.
D	In hospital	In hospital, nursing home or similar place.
E	In special unit	In a restricted area of a hospital such as intensive care unit or similar place.

PHYSICAL ACTIVITY SCALE

Scale	Step	Definition
A	Walked freely	With no limitations of any kind.
B	Walked with limitations	With cane, crutches or mechanical aid; or limited in lifting, stooping, or using stairs or inclines; or limited in speed or distance.
C	Moved independently in wheelchair	Propelled self alone in wheelchair.
D	In bed or chair	For most or all of day.

Source: Adapted from Patrick et al (1973 a)

An important feature of this classification lies in its recognition of the prominence of the work ethos in our society. Someone unemployed other than having retired must, by definition, be functioning at a low level of social health. The advocacy of a scale using letters of the alphabet is to highlight the lack of equal intervals between the steps.

After completion of a provisional questionnaire, a small pilot study was performed and several changes initiated on the basis of the responses to that. The final form of the questionnaire is shown in Appendix 1.

Standard definitions to most terms in the questionnaire have been used. In others, definitions have been adopted and questions framed to enable comparisons to be made with other studies.

For questions about respiratory symptoms (26,27 and 28) four sets of replies were devised. These are identical to those of the Pneumoconiosis Field Research (Jacobsen, 1977) and are illustrated in Figure 10.

Miners in the second category with persistent cough and phlegm, but no breathlessness, would certainly come at least into the diagnosis of simple chronic bronchitis, and although it is not reliable to diagnose chronic obstructive bronchitis in the absence of pulmonary function tests, many if not all in the third category with persistent cough and phlegm and breathlessness, would almost/...

almost certainly be diagnosed as having chronic obstructive lung disease (Medical Research Council, 1965). Even the first category, without persistent symptoms, may include men with considerable respiratory disability, either at certain times of the year or while at work or on exercise.

Figure 10: Classification of Respiratory Symptoms.

1. No persistent cough, phlegm or breathlessness	No to questions 26d, 27d and 28.
2. Persistent cough and phlegm but no breathlessness	Yes to questions 26d and 27d but no to 28.
3. Persistent cough and phlegm and breathlessness	Yes to questions 26d, 27d and 28.
4. Breathless, but no persistent cough or phlegm	No to questions 26d and 27d; yes to 28.

? WHEEZE

Source: Jacobsen (1977)

A current smoker was categorised as one who answered yes to question 31a and an ex-smoker one who answered no to question 31a and yes to question 31b. A non-smoker replied no to both.

Question 55e was devised principally to elicit responses from anyone in contact with voluntary or patient organisations. It/...

It was felt that some ex-miners may be members of organisations such as the Chest, Heart and Stroke Association or the British Rheumatism and Arthritis Association.

The Bedroom Standard is generally agreed to be the most satisfactory estimate of overcrowding (CSO, 1977). Questions 58, on the number of persons in the household, and 64, on the number of rooms available, were designed to assess this. In this system a separate bedroom is required for each married couple, each single person over the age of 21, each pair of the same sex aged 10 to 20, and each pair under 10. Unpaired household members aged 10 to 20 are paired with unpaired aged under 10 if they are of the same sex. Only rooms designated as bedrooms are reckoned and the number available above and below the standard is counted.

During the small pilot study it became apparent that there would be difficulties both in answering and interpreting question 66 which dealt with economic level, largely because of the extremely complex financial arrangements existing in some households. In some cases the mineworkers to whom I spoke had no knowledge of the total incomes of their working sons and daughters who invariably paid 'digs' to the man's wife. This meant that it would not be possible to calculate per capita family income.

4.2. 7. Interviewing the Former Nellie Coalworkers

A great deal of preparation took place in an attempt to maximise support and co-operation among the men involved and to ensure a/...

a high response rate.

Firstly, an initial meeting took place in Kirkcaldy in October, 1976 with miners and ex-miners from different parts of Fife to prepare the groundwork for the study.

Secondly, in April, 1977 I attended a meeting of Seafield Colliery Branch of the National Union of Mineworkers (NUM) in Kirkcaldy and enlisted its support.

Thirdly, throughout the study, I met regularly with the retired Nellie delegate to keep him abreast with developments that he could relay informally to the rest of the men.

Fourthly, through the good offices of the late Secretary to the Scottish Area NUM, I arranged a small insert (Appendix 2) in the October, 1977, issue of "Scottish Miner". This newspaper is provided free to all working miners and many former miners in Scotland.

Fifthly, a small article in the local newspaper in December, 1977, informed and reminded people about the study (Appendix 3).

Finally, each mineworker selected for interview received a personal communication in January or February, 1978 (Appendix 4).

The first miner was visited on the 23rd January, 1978, and all the interviews were completed 18 days later by working at this task/...

task full-time from morning until late in the evening.

One minor problem which arose during the interviews was that many of the men had changed addresses without notifying the Health Board. Fortunately, I had anticipated that this might be the case and checked each address with the most recent edition of the electoral roll. For those no longer resident at the addresses recorded by the Health Board, questioning of neighbours, friends, relatives and the other miners soon revealed their present addresses. By speaking to their relatives I learned that 2 new recruits from West Fife out of the total of 68 men selected for interview no longer lived or worked in Fife. One was in London and the other in Iran although both were still registered with local general practitioners. Although 15 (23%) of the remaining men did not reside at the addresses notified to the Health Board, all 66 were visited and successfully interviewed.

4.2. 8. Confirmatory Study

It could not be claimed that this study had adhered to the WHO concept of health had all the findings been based only on the results of interviews with the men. As already noted a normative component is an essential element of this paradigm of health. Accordingly it was felt necessary to verify and amplify responses to the questionnaires by gaining access to health service records and by conversing with the men's general practitioners. However, it was not considered essential to do this for all the men interviewed since it seemed that many would have little of note in their/...

their medical histories. In the event, a very selective approach was adopted. GPs were interviewed and hospital records examined for each man fulfilling all the following criteria on the basis of his replies to the questionnaire:

(i) had an impediment to his present functional health
(ii) attributed this disability directly to his previous work in the mining industry
(iii) had left the mining industry before retirement age on account of this disability.

Before the establishment of a specialist service in Fife in the 1960s, many miners with accidents and other orthopaedic problems were referred to a hospital in Tayside. All the available records both at this hospital and at other hospitals in Fife were examined for men fulfilling the above criteria. In addition all the GPs willingly provided access to their practice records and discussed with me each of their patients' medical problems. In this way I was able to build up a comprehensive picture of the health of these ex-Nellie mineworkers.

4.2. 9. Statistical Methods

Conventional statistical methods are employed throughout this thesis. However, it is pertinent to comment on a few which are of particular relevance.

4.2. 9.1. Calculation/

4.2. 9.1. Calculation of Cohort Mortality

Where men of the same age are followed up for several years, or men of different ages for one year, little problem is experienced in computing cohort mortality. The present task, however, is rather more complex for it entails the follow-up of a cohort of men of different ages for widely varying time periods over many years. Nevertheless, the actuarial mathods required to handle such multiple decrement tables have been documented in detail (Benjamin and Haycocks, 1970).

Let

l_x = the number of men living at age x at the start of the rate year

b_x = the number of men at age x at the beginning of the investigation

θ_x = the number of deaths occurring at age x

w_x = the number of withdrawals at age x

e_x = the number of men alive at age x at the end of the investigation,

where x is the age at the last birthday.

Now every individual who enters the investigation must pass out of observation, i.e. every b must be included in w, θ, or e.

Then/

Then,

$$\sum b_x = \sum w_x + \sum \theta_x + \sum e_x \qquad (10)$$

If we assume that each person will contribute 1 year of exposure to each rate year at each age except in the first year of the study when each person will on average contribute only $\frac{1}{2}$ year of exposure at his age of entry, and in the year he passes out of observation when again on average his contribution will be $\frac{1}{2}$, then the Central Exposed to Risk population (E^c) in the life year y to (y + 1) is

$$E_y^c = l_y + \tfrac{1}{2}b_y - \tfrac{1}{2}\theta_y - \tfrac{1}{2}w_y - \tfrac{1}{2}e_y \qquad (11)$$

But l_y is the total number of lives which have entered prior to age y less all those lives which have ceased to be included prior to age y. Expressed mathematically,

$$l_y = \sum_{}^{y-1} b_x - \sum_{}^{y-1} w_x - \sum_{}^{y-1} \theta_x - \sum_{}^{y-1} e_x \qquad (12)$$

for the rate year of life y to (y + 1).

Substituting (12) in (11) we have

$$E_y^c = \sum_{}^{y-1} (b_x - w_x - \theta_x - e_x) + \tfrac{1}{2}b_y - \tfrac{1}{2}\theta_y - \tfrac{1}{2}w_y - \tfrac{1}{2}e_y \qquad (13)$$

And, the mortality rate at a given age is

$$m_y = \theta_y / E_y^c \qquad (14)$$

4.2. 9.2. Mortality Comparisons

When dealing with a small cohort such as the present one, the most suitable method of comparing different mortality experiences is by the method of indirect standardisation. This allows for inevitable differences in age distributions between groups. The method requires that we calculate the number of deaths that would be expected in a group, A, if that group had experienced the same age-specific death rates as a 'standard' group, S. Thus, if there are d_i deaths among r_i persons at risk in the i^{th} age group in group A, and D_i deaths among R_i persons at risk in the corresponding age group of the standard population, S, the ratio of the observed number of deaths to the expected number is an index of the relative mortality adjusted for differences in age between the two groups, A and S. This ratio is the Standardised Mortality Ratio,

$$SMR = \frac{\sum d}{\sum rD/R} \qquad (15)$$

and a close approximation to the variance of the SMR, on the albeit unlikely assumption that all deaths are statistically independent events behaving as Poisson variables (Yule, 1934) is

$$V(SMR) = \frac{(SMR)^2}{\sum d} \qquad (16)$$

Now, equation (15) is related to equation (13) since $r_i = E_i^c$ and $\theta_i = d_i$.

Hence/

Hence, for our cohort,

$$SMR = \frac{\sum \theta}{\sum E^c D/R} \qquad (17)$$

A simple method of comparing the significance of the SMR is based on the χ^2 statistic, in which

$$\chi^2_1 = \frac{(\sum \theta - \sum E^c D/R)^2}{\sum E^c D/R} \qquad (18)$$

However, a more powerful test, particularly in the present situation, which involves a small number of deaths, is derived from the exact tail probability of the Poisson distribution, for which tables of significance factors have been computed by Bailar and Ederer (1964) for the ratio of a Poisson variable to its expectation.

4.2. 9.3. Methods of Analysis of Interview Responses

In the case of responses from the recruits, there are no methods of estimating the variance of the whole population since all recruits not living in Fife were automatically excluded from the investigation on logistic grounds. In these circumstances, therefore, calculation of the extreme range of proportions, on the assumption that all or none of the non-interviewed recruits possessed a certain characteristic, is the only valid means of making generalisations. However, statistical methods do exist for handling stratified simple random samples (Som, 1973), which are applicable to the analysis of the responses from the cohort survivors residing in West Fife District.

Let/

Let us consider two cases, the estimation of the universe proportion and the estimation of the universe total and mean.

Using the same notation as before, it has already been noted that the variance of the universe proportion is

$$V_P = \frac{1}{N^2} \sum \frac{N_h^2 P_h (1 - P_h) (N_h - n_h)}{n_h (N_h - 1)} \qquad (1)$$

However, P_h is unknown and must be estimated:-

Let r_h = the number of individuals in a sample n_h of the h^{th} stratum with a given characteristic.

Then $p_h = r_h / n_h$ (19)

An unbiased sample estimator of the universe proportion is

$$P = \sum N_h P_h / N \qquad (20)$$

$$s^2_{p_h} = \frac{p_h (1 - p_h)}{n_h - 1} (1 - n_h/N_h) \qquad (21)$$

where the term $(1 - n_h/N_h)$ is a finite correction factor for sampling without replacement.

The sampling variance of P is shown in equation (1) and an unbiased estimator of this is/

is

$$s_p^2 = \frac{1}{N^2} \sum \frac{N_h^2 \, p_h \, (1 - p_h)}{(n_h - 1)} (1 - n_h/N_h) \qquad (22)$$

The probability limits of the universe proportion p are provided by

$$p \pm t. \, s_p \qquad (23)$$

where t refers to the Student distribution.

Similarly an unbiased sample estimator of the stratum total Y_h obtained from the h^{th} stratum is

$$y_h = N_h \bar{y}_h \qquad (24)$$

where $\bar{y}_h$ is the sample mean.

Unbiased sample estimators of the universe total Y, and mean $\bar{Y}$ are respectively

$$y = \sum N_h \bar{y}_h \qquad (25)$$

and

$$\bar{y} = \sum N_h \bar{y}_h / N \qquad (26)$$

Unbiased estimators of the variances of y_h, the stratum total and $\bar{y}_h$, the sample mean are respectively

$$s_{y_h}^2 = \frac{N_h^2 \sum (y_h - \bar{y}_h)^2}{n_h \, (n_h - 1)} (1 - n_h/N_h) \qquad (27)$$

and/

and

$$s^2_{\bar{y}_h} = s^2_{y_h} / N_h^2 \tag{28}$$

Equations (27) and (28) lead to the sampling variances of the estimators of the universe total Y, and universe mean $\bar{Y}$, which are respectively

$$s^2_y = \sum s^2_{y_h} \tag{29}$$

and

$$s^2_{\bar{y}} = s^2_y / N^2 \tag{30}$$

Probability limits of the universe total and mean are provided by

$$y \pm t.s_y \tag{31}$$

and

$$\bar{y} \pm t.s_{\bar{y}} \tag{32}$$

respectively, where t again refers to the Student distribution. In equations (23), (31) and (32) the number of degrees of freedom, n* is required for a stratified simple random sample. This differs from that of a simple random sample, and

$$n^* = \frac{(\sum s_h^2)^2}{\sum \left(\frac{s_h^4}{n_h - 1}\right)} \tag{33}$$

5. Results - Health Care in West Fife District.

5.1. General Background Information

At the reorganisation of the National Health Service in 1974, Fife Area Health Board (AHB) assumed responsibility for the services for the whole of the county of Fife, and when the county of Fife became Fife Region in 1975 at the time of Scottish local government reorganisation, it was the only region of Scotland to maintain its boundaries unchanged.

Fife lies on the east coast of Scotland, bounded on the east by the North Sea, on the south-west by Forth Valley, and with a range of hills forming a natural western border with Tayside. To the north the Firth of Tay separates Fife from Tayside, and across the Firth of Forth in the south lies Lothian (Figure 1, p.3). Although Fife forms a peninsula, the effect of this has been considerably modified by bridges both to the north and the south, and by the rail and road network linking them. Rail bridges dating from the 19th century stand alongside road bridges constructed in the 1960s and connect Fife with Dundee in Tayside and Edinburgh in Lothian. In addition a road bridge across the River Forth at Kincardine links Fife with Glasgow in the west.

Fife has an area of 130,700 hectares and a long and varied coastline stretching for 185 kilometres. The topography is undulating with a succession of cultivated valleys and hills, the highest of which rises to no more than 522 metres, and most of the drainage is conducted to the sea by a considerable number of small streams.

The/

The headquarters of Fife AHB are in Dunfermline with offices in Kirkcaldy and Cupar. The area is divided into two health districts, West Fife District based in Dunfermline and East Fife District in Kirkcaldy. In 1976 an estimated 124,200 people lived in West Fife District and 213,500 in the East, making the total population of Fife 337,700.

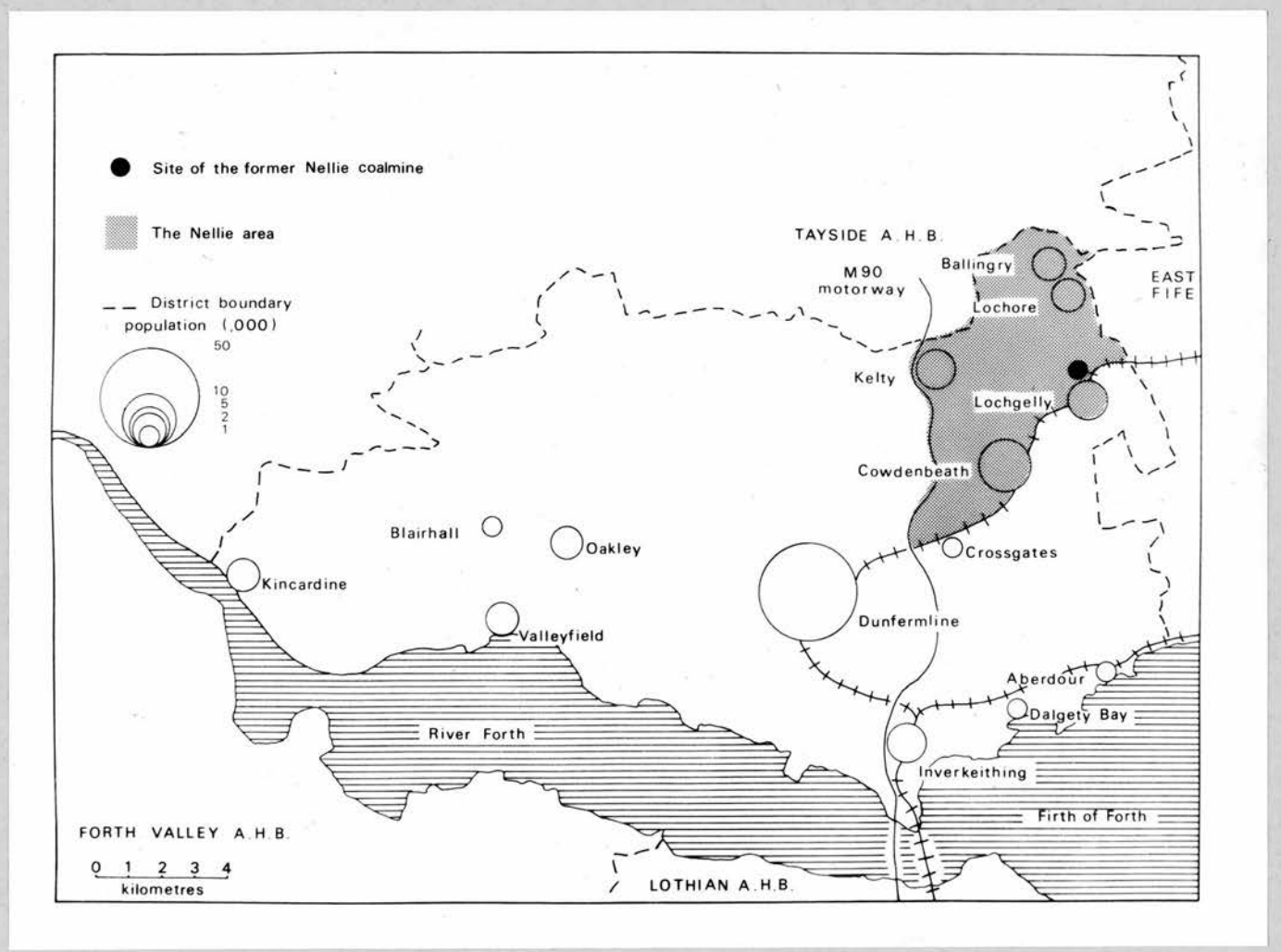
The headquarters of Fife Regional Council are in Glenrothes new town, the geographical centre of the Region. The Region is further divided for local government purposes into three districts, based in Dunfermline, Kirkcaldy and Cupar. Dunfermline local authority district corresponds exactly to West Fife District of Fife AHB. It is a mixed rural-urban area and the town of Dunfermline, with 53,400 inhabitants, is the largest in the Region. East Fife District of Fife AHB is divided for local government purposes into North East Fife District and Kirkcaldy District. North East Fife District is a rural area with important farming, fishing and tourist industries and a university at St. Andrews. Kirkcaldy District, stretching along the coast from Burntisland to Leven includes the town of Kirkcaldy, the second most populous in Fife with 50,100 inhabitants and Glenrothes the Regional capital (population 32,000). It is a mixed rural-urban local authority district.

5.1. 1. <u>West Fife District and the Nellie Area</u>

The estimated population of West Fife District in 1976 was 124,227. The history of the people of this area has been synonymous with that of coalmining for hundreds of years and the Nellie pit was one of many/...

many worked in the north-eastern part of the district until the 1960s when most were closed down. It was situated on the northern boundary of the town of Lochgelly and employed men from nearby towns and villages. For convenience I have designated this part of West Fife District the "Nellie area" (Figure 11). It/

Figure 11: Map of West Fife District Showing the Nellie Area.



It includes the town of Lochgelly itself (population 7,700) and the surrounding towns of Cowdenbeath (10,250), Kelty (6,500), Ballingry/...

Ballingry (4,300) and Lochore (3,000). Several smaller settlements make up the rest of its total population of approximately 38,000.

Accounts of the social history of the Nellie community from the middle of the last century have been documented by Brown and Westwater (1954), Cunningham (c. 1908), Holman (1909), Moffat (1965) and Muir (1953). Lochgelly was no more than a hamlet until the 19th century, and even by 1815, the total production of coal from all Lochgelly mines was a mere 50 tons per day. In 1872 the Lochgelly Iron and Coal Company was formed but it ceased all iron production after only three years. The Company founded the Nellie colliery in 1880 but closed it down in 1894. When it reopened the pit in 1905 it sank two shafts to a depth of 550 metres and installed modern coalcutting machines. Three years before an underground fire resulted in its premature and sudden closure in October, 1965, 400 men were employed at the mine and its annual output of coal was 116,000 tons.

During the 19th, and even into the 20th century, the life of miners and their families in the Nellie area was appalling. Earthen- or brick-floored terraced cottages, or "miners' rows", lacking water, toilets, baths, gas or electricity existed into the present century. Behind these lay the "privy-middens", open areas which served for the disposal of all manner of household waste and which were emptied only at monthly intervals. There was a complete dearth of local amenities such as street lighting, and working conditions were atrocious. Pit-head baths, for example, were not built at the/...

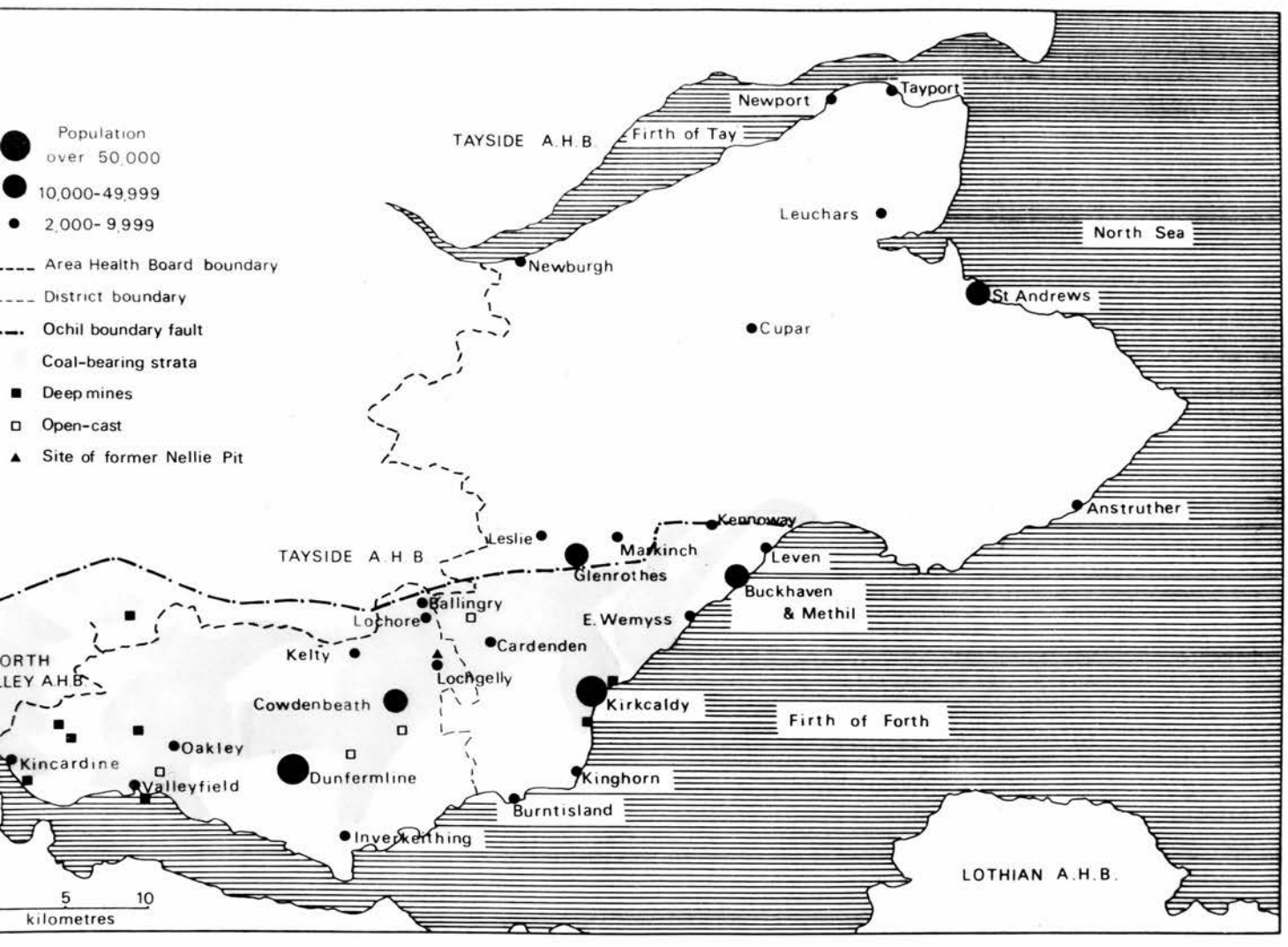
the Nellie until December, 1955. Yet, if anything, the mining people of this area were better off than their counterparts in the Lothian, Lanarkshire and Ayrshire coalfields. Primary schooling was available for miners' children at the Company school from around 1850 for 2d per fortnight, and miners who had the time and energy could attend evening classes. Lochgelly miners themselves established two literary societies in 1852 and the village had a scientific society and library. During last century the first "Gothenburgs" in Scotland were opened in this area. These licensed premises, set up by the miners themselves, generated profits to provide street lighting and other public utilities. Fife miners established an eight-hour working day in 1880, 28 years before the rest of the country. The first mines' rescue station in Scotland was opened in this part of West Fife in 1910, and a local coal company inaugurated a convalescent home for its employees in 1927.

Although their lot has improved beyond all recognition from that portrayed above, the people of this area still have many problems. Since 1961 the Nellie community has experienced a decline of over 10% in population, employment and shopping facilities and Fife Regional Council (1976 a) has designated it as an area of deprivation.

Employment has altered considerably during the last 25 years and the coalmining industry has been affected more than any other. In the early 1960s over 30 Fife coalmines were in production but this has now fallen to 8 deep mines and 4 opencast schemes (Figure 12). In 1961 the NCB employed 18,600 miners in Fife but only 7,500 in/...

in 1974 (Fife Regional Council, 1976 b). Nevertheless/

Figure 12: Map Showing the Extent of the Fife Coalfield, Coalmines and Opencast Workings.



Nevertheless it remains its largest single industrial employer with over 8,000 employees of all grades. In the Nellie area around /...

around 11% of all registered workers are engaged in mining and quarrying compared with 6.8% for the whole of Fife. Unemployment, however, has reached the dimensions of a local disaster for this quarter of West Fife. Late in 1977, 24.3% of registered males and 17.3% of registered females were unemployed. The figures for the whole of Fife fluctuate around 10%.

Transport to, from and within the Nellie area is very variable indeed. In 1971 less than 20% of households owned cars (Fife Regional Council, 1976 a). Most people have to rely on bus transport in an area where the structuring of routes frequently makes it necessary to take more than one bus between adjacent towns. The lack of transfer ticket arrangements between routes adds expense to inconvenience. Rail transport has been severely curtailed in the last 20 years and is of virtually no importance for access to local health services. Even in other parts of Fife outside the Nellie area, rail transport is poor, with no direct connection between the two principal towns of Dunfermline and Kirkcaldy, and no rail link at all with the Regional capital, Glenrothes. The rail network, however, remains an important form of communication with Edinburgh in Lothian and Dundee in Tayside. These links are vital factors in the social and industrial life of the community and are used to a variable extent by patients and their relatives referred to the regional specialist services in these larger centres.

Housing remains one of the most important factors contributing to the quality of life, and adequate housing not only satisfies a/...

a direct need but also has a major influence on the health of the community. At the last census 67% of the houses in West Fife were public rented houses provided by Dunfermline District Council or the Scottish Special Housing Association. In 1971 4.5% of all households in the District were classified as overcrowded and 8% of all houses lacked at least one of three basic amenities, hot water, a fixed bath or shower, and in inside toilet. Since that time, however, programmes of house-building and modernisation have continued both in the private and public sectors and nearly all dwellings in the District now possess these minimum amenities.

Most people now believe that leisure and recreation facilities contribute to the health of a community. A large countryside park created on the site of former coalmines is the Nellie area's most significant leisure amenity, but the area as a whole, scarred as it is by coal bings and opencast mining, is not aesthetically pleasing. Furthermore, although a range of recreational facilities exists throughout Fife, these are not always readily accessible to residents of the Nellie area because of transport difficulties already noted.

5.2. Health Services for the Nellie Community

Several organisations provide health care to the ex-Nellie coalworkers of West Fife. Some are concerned primarily with delivering health care to individuals and some mainly with environmental health in its widest sense although for several there is an overlap of function between these two categories. The emphasis placed by these bodies, however, on their approach to health care appears to warrant such a/...

a subdivision, and it is helpful to distinguish them in this way for the purpose of commenting on the overall organisation of health care within the locality. The relevant organisations are listed in Figure 13.

Figure 13: Principal Organisations Providing Health Care to the Nellie Community in West Fife.

Individual health care

National Health Service

National Coal Board Medical Service

Fife Regional Council Social Work Department

Voluntary Organisations

Environmental health

Dunfermline District Council Environmental Health Department

Fife Regional Council Water Services Department

Fife Regional Council Drainage Department

Forth River Purification Board

Health and Safety Executive

Industrial Pollution Inspectorate

Ministry of Agriculture and Fisheries Animal Health Division

5.3. Individual /

5.3. Individual Health Care

5.3. 1. The National Health Service

Responsibility for the administration of NHS resources in Fife lies in the hands of the 21 members of Fife Area Health Board (AHB) appointed by the Secretary of State for Scotland. It is advised by the Area Executive Group consisting of a Secretary, Chief Administrative Medical Officer, Chief Area Nursing Officer and Treasurer. Day-to-day administration at East Fife District and West Fife District is carried out by District Executive Groups, each comprising Administrator, Finance Officer, Medical Officer and Nursing Officer. Three consultative bodies, the Local Health Councils, monitor and advise on services in each of the three local authority districts, North-East Fife, Kirkcaldy and Dunfermline. West Fife Local Health Council is concerned with affairs in the Nellie area. It has 23 members, 2 appointed by Fife Regional Council, 6 by Dunfermline District Council, 3 by Fife AHB, 9 nominees from voluntary bodies and 3 from trade unions and professional associations.

It is anomalous that, under present legislation, NHS responsibility for health care stretches no further than the seashore. This is a particularly serious omission in view of Fife's importance to the development of oil and gas resources in the North Sea. At any one time as many as 10 oil rigs may be anchored off-shore in the Firth of Forth, yet none of the men working on them is covered for services by the NHS in Fife.

5.3. 1.1. Primary /

5.3. 1.1. Primary Care Services

On the 1st October, 1976, 341,382 people were registered with the 161 general medical practitioners in Fife. Compared with the estimated mid-1976 population of 337,711 this is an over-registration of 1%. Primary care facilities are provided locally to the Nellie community by GPs in the four principal towns of the area (Table 8) and by other GPs in surrounding towns. The/

Table 8: General Medical Services in the Nellie area of West Fife.

Town	Number of GPs	Patients				
		on lists	per GP	under 65(%)	65 - 74 (%)	over 75(%)
Cowdenbeath	6	12,740	2,123	85	10	5
Lochgelly	4	10,568	2,642	87	9	4
Ballingry	3	6,666	2,222	88	8	4
Kelty	2	5,939	2,970	86	10	4
Total	15	35,913	2,394	86	9	5

The practitioners in Cowdenbeath form a partnership and work from a health centre which has been upgraded from its former status as a clinic. The GPs in Ballingry also form a partnership and practice from their own purpose-built premises in the town. The remaining doctors are single-handed and practice from premises of their own which are very variable both in type and quality. The Scottish Medical Practice Committee has designated 15 districts throughout Scotland as under-doctored and two of them are in the Nellie/...

Nellie area. Lochgelly has been designated since 1963 and Kelty since 1966.

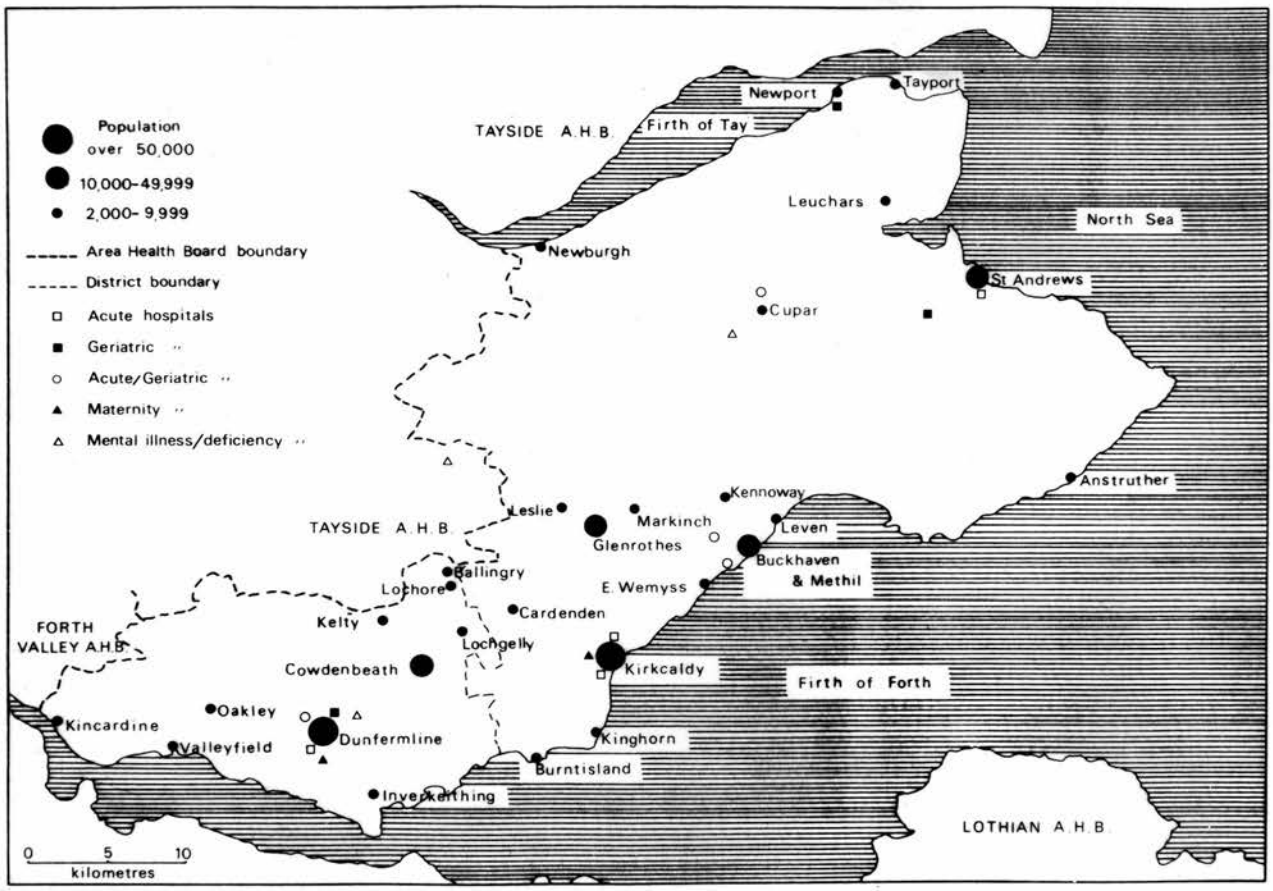
Primary care dental services are available in the three largest towns of the Nellie area, but several of the 8 general dental practitioners working there also have surgeries in other parts of Fife. Twenty-two of the 73 general dental practitioners in Fife have their principal work in West Fife District. A total of 11 retail chemists serve the Nellie community from premises in all 5 towns in the area, and 3 ophthalmic opticians have practices in each of the largest 3 towns. In addition dental, pharmaceutical andophthalmic services exist in the surrounding areas, and people frequently travel further afield for them, especially to Kirkcaldy and Dunfermline.

5.3. 1.2. Hospital Services

Although Fife is divided into two health districts, the Nellie area adjoins the district boundary and lies almost equidistant between the principal towns for hospital referral, Kirkcaldy and Dunfermline. There are no hospitals within the Nellie area itself and because of the considerable cross district flow of patients, these services in Fife must be viewed as a whole. Fife's only District General Hospital is at Kirkcaldy in East Fife District but there are also acute services at Dunfermline and elsewhere. Area-based inpatient services for respiratory and infectious diseases are near Kennoway in East Fife, for mental illness near Cupar, also in East Fife, and for mental deficiency at Dunfermline in West Fife. Fife AHB administers a total of 16 inpatient hospitals (Figure 14) and these/...

these provide a wide range of services (Figure 15). Patients/

Figure 14: Map Showing Location of Hospitals Administered by Fife Area Health Board.



Patients are also frequently referred to hospitals in other health board areas, principally for the regional specialty services situated at Dundee in Tayside and at Edinburgh in Lothian.

It is difficult to estimate the overall adequacy of the hospital/...

services in Fife. Patients are likely to judge this, among other ways, by how long they must wait for an outpatient appointment, and by how long they must wait for inpatient treatment once their name has been added to the waiting list for admission. In/

Figure 15: Distribution of Beds by Specialty and by Hospital in Fife.

Specialties / Hospitals	General surgery	Orthopaedic surgery	ENT	Ophthalmology	Urology	Gynaecology	Paediatric surgery	Total surgery	Paediatric medicine	General medicine	Respiratory medicine	Total medicine	Total DGH acute specialties	Specialist obstetrics	Special care baby unit	Total obstetrics	Geriatric assessment	Geriatric longstay	Total geriatric	Mental illness	Mental deficiency	Adolescent and child psychiatry	Total psychiatry	Communicable diseases	Convalescent	Other	Total available staffed beds
West Fife District																											
Dunfermline and West Fife	64	44				20	5	133					133														133
Milesmark										80		80	80				43	24	67						40		187
Northern																		65	65								65
Dunfermline maternity														50	18	68											68
Lynebank																				390			390				390
Glenlomond																				132			132				132
District total	64	44				20	5	133		80		80	213	50	18	68	43	89	132		522		522		40		975
East Fife District																											
Adamson																		30	30							25	55
Cameron											53	53	53					178	178					71	25		327
Craigtoun																		8	8							12	20
Forth Park														128	25	153											153
Hunter																										28	28
Netherlea																		12	12								12
Randolph Wemyss																		68	68							15	83
St. Andrews Memorial																										37	37
Stratheden																				824		45	869				869
Victoria	78	64	30	26	20	30	9	257	20	90		110	367				70		70	24			24				461
District total	78	64	30	26	20	30	9	257	20	90	53	163	420	128	25	153	70	296	366	848		45	893	71	25	117	2,045
Area total	142	108	30	26	20	50	14	390	20	170	53	243	633	178	43	221	113	385	498	848	522	45	1,415	71	65	117	3,020

In Fife, both vary enormously according to the specialty and the hospital of referral. Urgent cases are seen immediately. Requests for "non-urgent" outpatient appointments fare less well. For some/...

some specialties patients may be seen within a week, but in others there is a delay of 5 months or more. For inpatient services the number of patients on the waiting list and waiting times may be useful indicators in spite of their well known deficiencies. People, for example, may remain on lists long after they have either succumbed to some other condition, or gained relief from their disability by natural process or by adaptation. On the other hand, where long waiting lists exist, GPs may be less inclined to refer patients for consultation in the first place, and consultants equally less inclined to add yet another name to a waiting list for admission with little prospect of this being achieved in a reasonable period of time. However, when the orthopaedic waiting list at one Fife hospital was recently checked and updated, 300 on it for over 2 years, 184 for between 1 and 2 years and 163 for over 6 months still wished to be considered for admission. For all specialties in Fife the latest available information shows that 15% of patients had been awaiting admission for over 2 years, at least 30% for over 1 year, and 47% for over 6 months (Table 9).

Ancillary services are available at all Fife hospitals, with a comprehensive range at Kirkcaldy and Dunfermline. An area-based laboratory service is situated at Kirkcaldy and there is a branch laboratory at Dunfermline. Outwith the authority of Fife AHB the Common Services Agency provides an ambulance and blood transfusion service. In addition to inpatient facilities there are 4 day hospitals in Fife, 2 in each district, and 3 paediatric day centres, 2 of which are in West Fife. One of the latter is in the Nellie area.

5.3 1.3 Community /

Table 9: Waiting List and Waiting Times for Admission to Fife Hospitals by Specialty, 1st October, 1977.

Specialty	Number of patients on waiting list				
	under 6 months	6 - 12 months	12 - 24 months	over 24 months	Total
General surgery	564	236	161	69	1,030
Orthopaedic surgery	356	238	304	473	1,371
ENT surgery	442	63	60	19	584
Ophthalmology	88	1	-	-	89
Urology	83	30	43	14	170
Paediatric surgery	28	-	-	-	28
Paediatric medicine	2	-	-	-	2
General medicine	15	-	-	-	15
Geriatric assessment	111	31	7	-	149
Gynaecology	299	7	20	6	332
Psychogeriatric	76	43		5	124
Total	2,064	1,244		586	3,894

5.3. 1.3. Community Services

Community services to the Nellie populttion, including physiotherapy, chiropody, and maternity and child welfare, are provided at clinics throughout the area. In addition domiciliary physiotherapy and chiropody is available. Dental caravans and mobile chiropody clinics are in use, with the former visiting schools in the area. A medical service for school and pre-school children in Cowdenbeath and Kelty/...

Kelty is organised by clinical medical officers at Cowdenbeath Health Centre but the service for Lochgelly, Ballingry and Lochore is administered from Glenrothes in East Fife. A school speech therapy service operates from Dunfermline. District nurses and health visitors working in the Nellie area are based in Kelty, and nurses and health visitors are attached to practices throughout the area. Fife AHB provides a service for the whole of Fife for the supply of community aids for the disabled from a clinic in Lochore, also in the Nellie area.

5.3. 1.4. Staffing and Finance

Fife AHB employes less staff and spends less money per capita than nearly all other Scottish mainland health boards, and it is one of 9 recommended for additional financial resources by the working party on Revenue Resource Allocation (SHHD, 1977). In the financial year 1976 - 77 its expenditure was £30.3 million, of which £1.1 million was capital and £29.2 million revenue. In 1977 Fife AHB employed around 5,000 staff (Table 10) yet it had less doctors, nurses, administrative and clerical, professional and technical, and ancillary staff per capita than nearly all other Scottish mainland Boards.

5.3. 2. The NCB Medical Service

The NCB medical service in Scotland is organised from the Board's Scottish headquarters in Edinburgh. It employs an Area Medical Officer, 2 Deputy AMOs and a radiologist. All recruits to mining have a pre-employment medical examination, performed by local GPs on contract, and a chest X-ray. All employees are offered a/...

Table 10: NHS Manpower (Whole Time Equivalents), Fife AHB, 30th September, 1977.

Medical		
Hospital	170.7	
Primary care	170	
Community	30.3	
		371
Dental		
Hospital	0.5	
Primary care	73	
Community	23.5	
		97
Nursing		
Hospital	2,265	
Community	250	
Administrative	16	
		2,531
Other staff		2,002
Total NHS staff		5,001

a chest X-ray every 4 years, and those with pneumoconiosis have two-yearly X-rays and lung function tests. Juvenile employees and rescue men have statutory medical examinations. These and other routine medicals account for much of the work of the area doctors.

Treatment centres are found at all larger coalmines but these are staffed by Registered General Nurses from 9 a.m. to 5 p.m. only. Enrolled nurses are also employed, but during some shifts first-aiders are the only staff on duty. Area doctors visit these treatment centres on a regular basis to conduct medical examinations and for consultations both on matters arising out of the periodic X-ray scheme and on general matters relating to occupational health in the mines.

The Medical Department also co-operates with the Scientific Department, one of whose functions is to measure workplace dust levels, and with the Institute of Occupational Medicine and other establishments in the conduct of long-term epidemiological research.

The NCB medical service exhibits two prominent features in relation to the health of its staff: when miners are discharged on grounds of ill health, it does not appear to inform their GPs about the event or the cause, and after miners have left employment, it has no routine follow-up procedure of any kind for them. GPs in the Nellie area frequently complained that they were expected to undertake the management of these men without assistance from the NCB and in/...

in ignorance of relevant medical information.

5.3. 3. Social Work Services

The Social Work Department of Fife Regional Council is responsible for social work services to the people of Fife. Its headquarters, senior administrators and Regional Advisers are in Glenrothes, but for day-to-day services the Region is divided into 7 areas, each in the charge of an Area Organiser. The Nellie area constitutes one such Area and its offices, from which two social work teams operate, are in Lochgelly. Each team comprises a senior social worker, 3 social workers, 1 trainee social worker, 1 social work assistant, 1 homemaker and 1 occupational therapist, and covers half the Nellie community on a geographical basis.

Only limited social work facilities exist in the Nellie area. There are 4 sheltered housing units for the elderly, each with 20 flats, and a meals-on-wheels service for 3 days a week during the school term. A home-help service exists and provision can generally be arranged within 24 hours. There is one children's home but no hostel or home for old people. Seven of the latter, however, are available in other parts of West Fife District. Nor are there any adult training centres locally, although there are two near Dunfermline. One with 30 places caters for the physically handicapped; the other has 90 places for the mentally handicapped. A regional homebound service exists for handicapped people in their homes. None of the above services, however, are managed by the local social work teams; they are centrally planned and run.

In/

In their Regional Report, Fife Regional Council (1976 a) emphasised the inadequacy of the level of provision of social work services to the people of Fife, highlighting shortfalls in virtually every branch of their work (Table 11). Neither are relations with the NHS all that they might be. Co-operation is formalised at senior officer level, but social work cover of the hospital service tends to be patchy. At the local level in Fife, only in Cowdenbeath in the Nellie area does there appear to be a well-organised structure, and a serious attempt at co-operation between the two services. At the health centre there, GPs, social work staff, clinical medical officers, health visitors and district nurses meet weekly to discuss the joint management of families and individuals with particular problems.

5.3. 4. Voluntary Organisations

Whether there emphasis is on providing a service or campaigning on behalf of a patient group, voluntary bodies play an important role in health care. An umbrella organisation called the Voluntary Organisations Regional Advisory Group (VORAG) exists in Fife to act as a forum for all types of voluntary bodies functioning in the Region. VORAG offers an advisory service and liaises with the Regional Council. Through its Scottish Committee it also deals directly with the Scottish Office. Appendix 5 lists the 18 voluntary organisations in Fife connected with health care which are registered with VORAG, with brief comments on their work. Two, the British Red Cross and the Women's Royal Voluntary Service, have members on Local Health Councils in Fife, the former on all three, and the latter on East Fife and West Fife Local Health Councils. A list of all the/...

Table 11: Social Work - Level of Service in Fife Region, 1974.

Service	Group	Need	Current level of provision	Short-fall
Social workers	Basic Grade SWs	131	36	95
	Assistant SWs	26	10	16
	Home helps	523	501	22
Child Care	Day nursery places	203	45	158
	Residential places	380	124	256
Elderly	Meals to elderly	8,720	4,377	4,343
	Sheltered housing	1,090	750	340
	Residential homes	1,308	671	637
Mentally Disordered	Foster homes, etc.	58	0	58
	Sheltered accom-modation	23	11	12
	Residential places	237	20	217
	Homes for mentally ill	68	11	57
	Day training places	506	227	279
	Day care centre places	101	0	101
	Rehabilitation day places	203	0	203
Physically Handicapped	Day centre places	101	24	77
	Residential homes	101	0	101
Miscellaneous	Hospital SW staff	18	10	8
	Residential places for homeless single people	151	91	60

Source: Fife Regional Council (1976 a)

the voluntary organisations represented on these Councils is in Appendix 6. Although others are known to function in Fife neither the British Rheumatism and Arthritis Association nor the Chest, Heart and Stroke Association appear to have local branches. Both would seem to be relevant to Fife's large population of coalworkers.

The most important voluntary organisation concerned specifically with the health and welfare of coalminers is the Coal Industry Social Welfare Organisation (CISWO), which has national headquarters in London, and a Scottish Welfare Committee in Edinburgh. It runs social clubs, mainly for entertainment purposes, and two of these are in the Nellie area. It also has convalescent homes throughout Scotland, one of which is situated in West Fife District. Various charitable organisations and hospitals benefit from its financial assistance. It operates several benevolent trusts and funds to help the widows and children of the victims of mining accidents, and to help paraplegic or severely disabled miners, and it provides a wide range of services for the welfare of the sick, the disabled and the elderly. To publicise these facets of its work it co-operates, too, with social workers. Apart from activities orientated towards health CISWO has other interests in the fields of education, sport and entertainment (CISWO, 1977 a; 1977 b).

The large number of voluntary organisations concerned with health care in Fife indicates a need for the type of activity they are striving to offer. By and large, however, the general public, professionals and people in need of help are not aware of their activities and/...

and functions. Although still in its infancy the establishment of VORAG is a potential means of increasing public awareness about the work of its members and of improving their organisational effectiveness.

5.4. Environmental Health

Environmental health services, in their widest sense, are most usefully discussed within a functional framework rather than the organisational one adopted to document the work of those in the personal health care field. This arises because of the considerable overlap in the activities of the relevant organisations.

5.4. 1. Water

Although the prime responsibility lies with the Water Services Department of Fife Regional Council, the provision of wholesome water to the Nellie community is a highly complex exercise involving several organisations. Each of three parts of the Nellie area receives its water supply from different sources. Two of these sources are outwith Fife in different parts of Tayside Region, although a trunk mains system allows interconnection between any of these sources in an emergency. The Water Services Department has its headquarters in Glenrothes, and it has laboratories to monitor water quality both there and at the site of a large, recently commissioned reservoir complex in Tayside.

Other bodies, however, are also involved in the provision of wholesome water. Quality control of all rivers, streams and inland/...

inland waters within the Forth basin is in the hands of the Forth River Purification Board, a statutory body consisting of 36 representatives of local government and appointees of the Secretary of State for Scotland. It has headquarters in Edinburgh, but within Fife a Divisional Inspector and his staff operate from offices in Kirkcaldy. Much of their work consists of monthly river sampling for chemical and biological analysis at the Board's laboratories, and they co-operate closely with the staff of the Water Services Department.

At the point of consumption of water, the Environmental Health Department of Dunfermline District Council also becomes involved when its Environmental Health Officers (EHOs) respond to calls from the public. Routine water samples from swimming pools and ad hoc water samples from domestic taps are collected for chemical and biological analysis at the Public Health Laboratories in Kirkcaldy in Fife or Dundee in Tayside.

5.4. 2. Food

Several organisations are involved in the monitoring of food quality from the health point of view. The Divisional Veterinary Officer of the Department of Agriculture and Fisheries Animal Health Division deals with meat, pig and poultry foodstuff before it reaches the retail stage. His office is in North-east Fife and laboratory facilities are in Tayside and in Edinburgh. Because his total staff in Fife comprises only 4 trained veterinary surgeons much of the work of the Division is done on contract by the 7 veterinary/...

veterinary practices in Fife. There are no slaughter houses in West Fife District but 4 are scattered throughout the East. Technically, veterinary surgeons examine all slaughtered meat but in practice only meat for export and suspect meat is inspected by them. Meat for local consunption is examined and passed by EHOs with meat inspection certificates working in the Environmental Health Departments of Kirkcaldy and North East Fife District Councils. A large industrial chicken processing plant in East Fife presents a major health problem. The plant design is such that live and processed birds are not completely separated, and Salmonellosis is endemic. Yet the Animal Health Division is severely restricted in the action it can take since the Zoonoses Order only makes compulsory the reporting of Salmonellosis; it does not enforce inspection of poultry for the condition. Moreover the Division has no powers to enter and inspect the poultry plant on its own volition. Much of the Division's work is the routine testing of cattle for tuberculosis and brucellosis, and Fife has recently been officially attested brucella-free. Another part of its work is the inspection for anthrax of all sudden animal deaths within Fife, and the monitoring of the many piggeries within the Region for swine vesicular fever and foot and mouth disease. In 1976 one sudden cattle death out of 800 notified proved positive for anthrax and the last major outbreak of foot and mouth disease was in 1967.

Milk production, processing and retailing in West Fife is monitored closely by the Milk Officer of the Environmental Health Department of Dunfermline District Council, which licenses and controls the 33/...

33 milk producers, the 3 producer-bottlers, the 3 pasteurisation plants and the 2 bottling plants in the District. Few supplies of milk are non-pasteurised and by 1980 pasteurisation will be universal. All milk produced in West Fife is from cattle attested tuberculosis- and brucella free, and the standard is high. Premises are checked routinely at 3 monthly intervals, and at 3 weekly intervals if a milk sample has failed biological and chemical testing at the Public Health Laboratory in Kirkcaldy. Three consecutive failures can result in a licence being revoked but no milk samples from West Fife in recent years have fared so badly. Antibiotic monitoring is done at the Public Health Laboratory in Dundee, Tayside.

Other food manufacturing and retailing, including ice-cream production, bakeries, restaurants and shops come under the aegis of the EHOs of Dunfermline District Council, who carry out periodic inspections of premises and product samples, and deal with complaints about food containing foreign bodies. Few such cases of adulterated food ever reach the courts of law despite the strictness of the public health laws. EHOs complain bitterly about the inordinate delays or rejection of their cases by the Procurator Fiscals long before they have even had the opportunity to come to court. Sheriffs fail to convict, admonish or give derisory fines to companies charged with these offences, and this had led in turn to disillusionment and cynicism among EHOs. It is now the case that most offences are ignored by the Environmental Health Department as far as the contemplation of pressing charges is concerned.

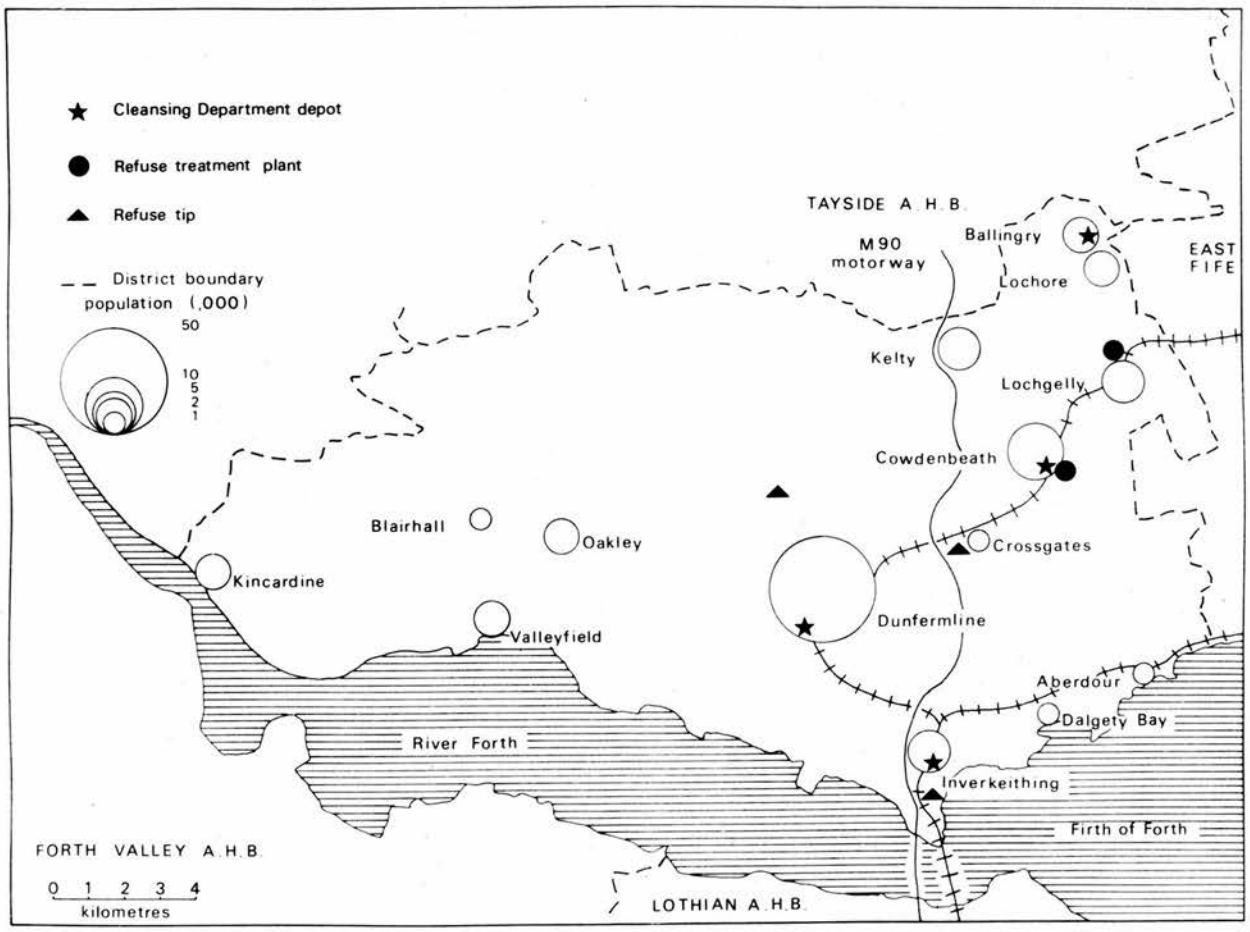
5.4. 3. <u>The/</u>

5.4. 3. The Disposal of Waste

The Cleansing Division of the Environmental Health Department of Dunfermline District Council is responsible for refuse collection in the Nellie area. Its main offices are situated in Dunfermline but it has depots throughout the District, two of which are in the Nellie area and serve that community. The Cleansing Division employs around 200 staff, including 150 refuse collectors and street sweepers, and has at its disposal two mechanical street sweepers and over 20 refuse lorries. Refuse is collected twice weekly. Domestic premises generally use disposable paper or plastic bags supplied by the District Council but high-rise flats and most industrial premises use large metal bins. There are two refuse treatment plants and three rubbish tips in West Fife and all refuse from the Nellie area is treated before disposal (Figure 16). Metal, paper and glass is removed and the residual waste either tipped or mixed with treated sewage. The resultant manure is then sold to the public. The disposal of poisonous waste is a highly complex issue but there are no tips licensed for this purpose in Fife. However, one private company in West Fife is permitted to dispose of asbestos on its own premises under supervision of EHOs. The siting of all kinds of tips in West Fife involves joint agreement by Dunfermline District Council, Fife Regional Council and the Forth River Purification Board, and the disposal of animal carcasses, particularly those with anthrax, involves both the Forth River Purification Board and the Department of Agriculture and Fisheries Animal Health Division.

Many/

Figure 16: Refuse Disposal Facilities of the Cleansing Division, Dunfermline District Council Environmental Health Department.



Many bodies co-operate, too, in the disposal of sewage. The situation is particularly complicated in the Nellie area. Dunfermline District Council Environmental Health Department is responsible for all public toilets in the area, and also for hygiene problems of private/...

private dwellings and premises from the pedestal to the main effluent drain in the street. At this point the Drainage Department of Fife Regional Council assumes responsibility for its treatment and, under the supervision of the Forth River Purification Board, for its disposal. Rural settlements make extensive use of septic tanks and most larger settlements in Fife have minimal or no treatment of domestic sewage. The only settlement of sizeable population in Fife which satisfactorily treats its sewage is Cowdenbeath in the Nellie area. In this town sewage is aerated, and the sediment mixed with treated refuse and sawdust. This mixture is then sold to the public as compost by Dunfermline District Council. The liquid effluent is fit for fish and plant life and is discharged into a nearby loch under the auspices of the Forth River Purification Board.

5.4. 4. Health and Safety at Work

The Health and Safety Commission, established under the Health and Safety at Work, etc. Act, 1974, is responsible for the health and safety of people at work. The Commission has a wide remit: "We are charged with taking appropriate steps to secure the health, safety and welfare of people at work, to protect the public generally against risks to health and safety arising out of the work situation, to give general direction to the Health and Safety Executive (HSE) and guidance to Local Authorities on the enforcement provisions of the Act, to assist and encourage persons with duties under the Act, and to make suitable arrangements for research and the provision of information" (Health and Safety Commission, 1977). The Commission relies heavily on the HSE for the implementation of/...

of the Act. In 1975 over 1¼ million premises were registered under various provisions, and these are supervised by enforcement authorities, the Factory Inspectorate, the Explosives Inspectorate, the Nuclear Installations Inspectorate, the Railways Inspectorate, the Mines and Quarries Inspectorate, and the Agricultural Inspectorate, all part of the HSE. In Scotland the Environmental Health Departments of the District Councils are jointly responsible with the Factory Inspectorate for establishments subject to the Offices, Shops and Railway Premises Act (OSRP Act), and the Industrial Pollution Inspectorate of the Scottish Development Department enforces the Radioactive Substance Act, 1960, and the Alkali (Scotland) Act, 1906. Another important branch of the Health and Safety Commission is the Employment Medical Advisory Service (EMAS), one of whose functions is to advise on medical aspects of occupational health and safety. EMAS employs one doctor part-time to deal with medical problems in Fife. West Fife District is in the East of Scotland Division of the HSE, based in Edinburgh. Five Principal Factory Inspectors specialising in various types of premises and an Area Director cover the east coast of Scotland. Each inspector has an average 500 to 700 factories or premises to cover, with the result that visits are made on average every 4 to 5 years. Some premises are visited much more frequently and some, especially building sites, not at all.

It is difficult to obtain a true perspective of the effectiveness of the machinery for enforcing legislation covering health and safety at work. On one morning I accompanied EHOs of Dunfermline District/...

District Council to inspect 5 shops under the OSRP Act. Not a single shop complied with the minimum requirements of the Act. I was informed that only 1 premise out of 500 inspected in the previous 6 months was found to comply with the law. Yet in no case had they issued improvement or prohibition notices. Nor had they discussed defects with the owners, managers or employees. After each inspection a report is made to the Director of Environmental Health who, in turn, writes to the owner or manager requesting action be taken on defects. It was generally felt that this situation had arisen because of a combination of circumstances: relatively young and inexperienced EHOs found it difficult to stand up to shopkeepers who had often considerable business experience; Procurator Fiscals declined to prosecute shopkeepers in breach of the acts; and Sheriffs refused to convict or punish offenders. This unsatisfactory situation appears equally applicable to health and safety in factories.

The monitoring of health and safety in coalmines differs from that in all other premises in that three levels of inspection are involved. One is the Inspectorate of Mines and Quarries. It is part of the HSE based in Edinburgh and has 4 District Inspectors to cover Scotland. Another is the NCB which employs its own safety officers. The miners themselves constitute the third group. Not only does the NUM employ full-time workmen's inspectors, but 4 part-time inspectors are employed at every coalmine. Even with this tripartite structure, however, coalmining remains a dangerous occupation and environmental conditions at work are extremely poor. On my visit to one of the largest, most mechanised, most productive collieries in Europe, Seafield Pit, Kirkcaldy, it was immediately obvious that facilities/...

facilities regarded as basic in any office or factory were absent. Although most men in the pit spent their entire shift underground near the face, there were no flush toilets, wash basins, rest rooms, canteen, nor even chairs. No place existed where miners could wash before eating or after the toilet. In addition the mine was wet, noisy and full of dust, with rough, uneven roadways littered with stones and other debris. The overall impression was one of a situation conducive to anything but health and safety at work.

5.4. 5. Other Aspects of Environmental Health

The Environmental Health Department of Dunfermline District Council is responsible for other aspects of environmental health. The District is divided into three, and an EHO and two assistants based in an office in Lochgelly deal with most general matters in the Nellie area, including noise abatement, offensive trades, smoke control, the sanitary aspects of housing and contact screening for communicable diseases. Rodent control and a few other specialist services, however, are handled by headquarters' staff in Dunfermline.

In all aspects of environmental health, community medical specialists (CMSs) play an important role as designated officers when called upon to do so by the appropriate authorities. All eight CMSs in Fife are designated, but three are most frequently involved in matters pertaining to the Nellie area. These include the District Medical Officer of West Fife and the CMSs with area responsibility for environmental health and for communicable diseases.

6. Results - The Health Experience of the Nellie Cohort.

6.1. Mortality

Between 1st October, 1955, and 30th September, 1977, 115 of the coalworkers are known to have died. The multiple decrement table used in the computation of cohort mortality is contained in Appendix 7, and the Central Exposed to Risk Population, E_x^c, derived from equation (13) (Page 107), is in Appendix 8. Table 12 summarises the mortality experience of the cohort of 427 ex-Nellie coalworkers.

6.1. 1. Mortality Comparisons

Because the Nellie cohort was a heterogeneous population followed up for 22 years, there is some difficulty in identifying suitable populations with which to draw comparisons.

The Decennial Supplements of the Registrar General for Scotland (1969 a; 1969 b) and for England and Wales (1971; OPCS, 1978 a) produced detailed mortality analyses centred on the census years 1961 and 1971 for various occupations. Relevant comparisons, including expected deaths, SMRs and standard errors (SE), between these and the Nellie cohort are in Table 13. The table also contains mortality comparisons based on the annual statistics of the Registrar General for Scotland (1957, 1967, 1976) for 1956, 1966 and 1975, three separate years at the beginning, middle and end of the study. In the Nellie cohort 53 men died between the ages of 20 and 64, 54 between the ages of 15 and 64, and 115 died overall.

Using/

Table 12: Summary of the Mortality Experience of the Cohort of 427 Ex-Nellie Coalworkers.

Age x	Central Exposed to Risk Population E_x^c	Deaths θ_x
15 - 19	161	1
20 - 24	380.5	0
25 - 29	605.5	0
30 - 34	885.5	1
35 - 39	1,061	1
40 - 44	1,032.5	2
45 - 49	1,006	6
50 - 54	932.5	13
55 - 59	753	10
60 - 64	583.5	20
65 - 69	417.5	22
70 - 74	259	11
75 - 79	146.5	12
80 - 84	57.5	13
85 - 89	7	2
90 - 94	2.5	1
	8,291	115

Table 13: Expected Number of Deaths, SMRs and Standard Errors for the Nellie Cohort Using the Mortality Experiences of Various Standard Populations.

Standard Population	Expected Number of Deaths in Nellie Cohort	SMR	SE
All men, 15 - 64, England & Wales, 1961[1]	50.00	1.080	0.147
All coalminers, 15 - 64, England & Wales, 1961[1]	57.14	0.945	0.129
All men, 15 - 64, England & Wales, 1971[2]	47.65	1.133	0.154
Miners & quarrymen, 15 - 64, England & Wales, 1971[2]	66.08	0.817	0.111
All men, Scotland, 1961[3]	127.62	0.901	0.084
All coalminers, 20 - 64, Scotland, 1961[4]	66.86	0.793	0.109
All men, Scotland, 1956[5]	129.81	0.886	0.083
All men, Scotland, 1966[6]	129.95	0.885	0.083
All men, Scotland, 1975[7]	122.27	0.941	0.877

1. Registrar General (1971)
2. OPCS (1978 a)
3. Registrar General Scotland (1969 a)
4. Registrar General Scotland (1969 b)
5. Registrar General Scotland (1957)
6. Registrar General Scotland (1967)
7. Registrar General Scotland (1976)

Using the tables produced by Bailar and Ederer (1964), it can be shown that none of the SMRs is significant at the 5% level, although the Nellie cohort mortality was higher than that of all men aged 15 - 64 in England and Wales in both 1961 and 1971, and lower than that experienced by coalminers, aged 15 - 64 in England and Wales in 1961 and by miners and quarrymen, aged 15 - 64 in England and Wales in 1971. For populations in Scotland, the SMR for the Nellie cohort was lower than that of all men in the years 1956, 1961, 1966 and 1975, and lower than that of coalminers aged 20 - 64 in 1961.

6.1. 2. Cause of Death

The underlying cause of death by age, classified by the 1965 revision of the International Classification of Diseases (WHO, 1967) is shown in Table 14. The numbers in each category are small and comparisons difficult to draw. Nevertheless, Table 15 documents the number of deaths expected among the Nellie coalworkers had they experienced similar patterns of death as all men in Scotland in 1965, 1966, 1975 and men aged 15 - 64 in England and Wales in 1971. Regrettably the occupational mortality tables for Scotland in 1961 are presented in a way which does not allow comparisons of this kind.

At the 5% significance level the Nellie cohort experienced more deaths from cerebrovascular disease than men aged 15 - 64 in England and Wales in 1971, and fewer deaths from ischaemic heart disease than all men in Scotland in 1975. The cohort also had more deaths from pneumoconiosis than all men in Scotland in the three years studied. In 1956 this was significant at the 5% level and/...

Table 14: Underlying Cause of Death by Age in the Nellie Cohort.

Cause of Death	Age								
	15-	25-	35-	45-	55-	65-	75-	85+	Total
Accidents (E800-999)	0	1	1	2	1	0	1	0	6
Malignancies (140-209)	0	0	1	4	11	9	5	1	31
of lung (162)	0	0	0	0	6	3	2	0	11
of bladder (188)	0	0	0	0	1	2	1	0	4
of prostate (185)	0	0	0	0	0	1	2	0	3
of stomach (151)	0	0	1	0	2	0	0	0	3
of brain (191)	0	0	0	2	0	0	0	0	2
of kidney (189)	0	0	0	1	1	0	0	0	2
of blood (200-209)	0	0	0	0	1	1	0	0	2
of colon (153)	0	0	0	0	0	1	0	0	1
of liver, secondary (197)	0	0	0	0	0	1	0	1	2
multiple (199)	0	0	0	1	0	0	0	0	1
Pneumoconiosis (515)	0	0	0	0	0	4	1	0	5
Cerebrovascular disease (430-438)	0	0	0	4	4	6	5	2	21
Ischaemic heart disease (410-414)	0	0	0	5	8	10	5	0	28
Chronic bronchitis (491)	0	0	0	2	2	2	1	0	7
Other vascular disease (390-404; 420-429; 440-458)	0	0	1	0	1	2	4	0	8
All other conditions	1	0	0	2	3	0	3	0	9
Total	1	1	3	19	30	33	25	3	115

Table 15: Observed and Expected Numbers of Deaths from Selected Causes in the Nellie Cohort.

Cause of death	Observed number of deaths		Expected number of deaths based on the mortality experiences of: all men, Scotland[1]			men aged 15–64 in England and Wales[2]
	All ages	15–64	1956	1966	1975	1971
All malignancies	31	16	26.3	28.5	28.9	12.9
Carcinoma stomach	3	3	4.3	3.5	2.8	1.4
Carcinoma lung	11	6	8.9	11.7	11.6	5.6
Ischaemic heart disease	28	13	27.0	37.2	41.4*	16.3
Bronchitis	7	4	5.5	8.5	5.6	2.6
Pneumoconiosis	5	0	1.2*	0.6**	0.4**	0.1
All accidents	6	5	6.4	7.1	6.9	3.6
Other accidents***	5	4	3.0	3.2	3.9	-
Pulmonary tuberculosis	0	0	2.3	0.8	0.3	0.2
Cerebrovascular disease	21	8	16.6	15.4	13.9	3.2*

* Significant at the 5% level.

** Significant at the 1% level.

*** Excluding motor vehicle accidents, poisonings, suicide and self-inflicted injury.

1 Annual Reports of the Registrar General for Scotland for the years 1956, 1966, 1975 (1957; 1967; 1976).

2 OPCS (1978 a).

and in 1966 and 1975 at the 1% level. Unfortunately it was not possible to determine how many of the causes of death had been confirmed by autopsies.

Three deaths are known to have resulted from non-mining accidents. Two men died in separate colliery accidents at the Nellie pit, but in only one case is it recorded on the death certificate that the accident was at a coalmine. In the sixth case the place of occurrence of the accident is neither recorded nor known.

The underlying cause of death, of course, does not give a complete picture, for it may exclude significant conditions contributing to the death. It can be seen from Table 16 that pneumoconiosis was a contributing factor in 2 cases, chronic bronchitis in 4, carcinoma of the lung in 1 and of the stomach in 1. Several other contributory factors were recorded on some death certificates, but these are perhaps less relevant to coalmining.

6.1. 3. Occupation and Mortality

The Registrar General classifies the occupation recorded on the death certificate into a number of groups according to the type of work done. All 112 men from the cohort who died in Scotland have been classified according to the 1970 classification of occupations (OPCS, 1970). Three men who died in England could not be classified because staff at the General Register Office, London, declined to provide this information. At least 15 men (27.8%) who died before their 65th birthday were coded to occupations other than coalmining, and for/...

Table 16: Significant Factors Contributing to Death in the Nellie Cohort.

Underlying cause	Contributing factor	Number
Cerebrovascular disease	Chronic bronchitis	2
Cerebrovascular disease	Pemumoconiosis	1
Ischaemic heart disease	Carcinoma lung	1
Ischaemic heart disease	Carcinoma stomach	1
Ischaemic heart disease	Chronic bronchitis	1
Hypernephroma	Pneumoconiosis	1
Carcinoma lung	Chronic bronchitis	1

for men of all ages the figure was at least 29 (25.2%) (Table 17).

Although the numbers in each category are small, no significant difference could be detected between coalminers and non-coalminers in cause of death. This applied to men who died at any age and to men who died before their 65th birthday (Table 18). When those whose recorded occupation was coalmining were subjected to more detailed scrutiny, again, no apparent pattern emerged between surface miners, underground miners and those for whom the site of work was unspecified (Table 19).

6.2. The/

Table 17: Occupations Recorded on Death Certificates of Deceased Ex-Nellie Coalworkers.

Occupational group		Age at death under 65	all ages
II	Underground coalminers (007)	24	46
	Coalminers, unspecified (007)	7	27
	Surface coalminers (008)	6	10
	All coalminers (007, 008)	37	83
I	Farmers, foresters, fishermen	1	1
V	Furnace, forge, foundry, rolling mill workers	0	1
VI	Electrical and electronic workers	1	1
VIII	Woodworkers	0	1
XI	Clothing workers	1	1
XIV	Makers of other products	1	1
XV	Construction workers	1	1
XVII	Drivers of stationary engines, cranes, etc.	3	8
XVIII	Labourers n.e.c.	4	7
XIX	Transport and communications workers	1	3
XXII	Sales workers	2	3
XXIV	Administrators and managers	0	1
	No occupational information	2	3
	Total	54	115

Table 18: Cause of Death by Age and by Occupation Recorded on Death Certificate for Ex-Nellie Coalworkers.

Cause of death	Deaths before 65th birthday		All deaths	
	Miners	Non-miners	Miners	Non-miners
Accidents	4	1	4	2
Malignancies	12	3	20	9
of lung	4	1	7	2
of bladder	0	1	2	2
of prostate	0	0	1	2
of stomach	3	0	3	0
of brain	2	0	2	0
of kidney	2	0	2	0
of blood	0	1	1	1
of colon	0	0	1	0
of liver, secondary	0	0	0	2
multiple	1	0	1	0
Pneumoconiosis	0	0	5	0
Cerebrovascular disease	4	4	14	7
Ischaemic heart disease	7	5	20	7
Chronic bronchitis	3	1	5	2
Other vascular disease	2	0	8	0
All other conditions	5	1	7	2
Total	37	15	83	29

Table 19: Cause of Death by Age and by Site of Work for Ex-Nellie Workers Whose Occupation on the Death Certificate was Coalmining.

Cause of death	Deaths before 65th birthday			All deaths		
	underground (007)	unspecified (007)	surface (008)	underground (007)	unspecified (007)	surface (008)
Accidents	3	0	1	3	0	1
Malignancies	6	4	2	12	6	2
of lung	3	1	0	6	1	0
of bladder	0	0	0	1	1	0
of prostate	0	0	0	0	1	0
of stomach	1	2	0	1	2	0
of brain	1	0	1	1	0	1
of kidney	1	0	1	1	0	1
of blood	0	0	0	1	0	0
of colon	0	0	0	1	0	0
of liver, secondary	0	0	0	0	0	0
multiple	0	1	0	0	1	0
Pneumoconiosis	0	0	0	3	2	0
Cerebrovascular disease	3	1	0	8	3	3
Ischaemic heart disease	6	0	1	10	9	1
Chronic bronchitis	1	1	1	3	1	1
Other vascular disease	2	0	0	3	4	1
All other conditions	3	1	1	4	2	1
Total	24	7	6	46	27	10

6.2. The Health of the West Fife Ex-Nellie Coalworkers

It has already been noted in the methodology (Figure 8, p.93) that the sampling frame for the investigation of health and health care in West Fife District was all 230 ex-Nellie workers still thought to be resident there. This group of men was first stratified by date of birth into those born before 1/1/36, the 195 non-recruits, and those born after 1/1/36, the 35 recruits. All the latter were included in the group to be interviewed along with a simple random sample of 29 of the former.

The Primary Care Division of Fife AHB supplied the addresses of all the men and this was checked against the electoral roll. Where address supplied by the former did not correspond with the latter, enquiries were made among the ex-Nellie workers themselves. In this way the whereabouts of all 64 men were discovered although the Primary Care Division had the wrong addresses in the case of 3 non-recruits and 14 recruits. An overall estimate of the number who had different addresses is therefore 34 out of the 230 (14.9%) with a standard error (SE) of 10.35 (4.5%), and the 95% confidence limits are 17 to 55 (7.4 - 24.1%).

Two recruits had to be eliminated from the study when it was discovered that, although they were still registered with local general practitioners, they were no longer living or working in Fife. The remaining 33 recruits and 29 non-recruits were traced in West Fife and all 62 were successfully interviewed. The West Fife cohort, therefore, eventually consisted of 228 men, 33 of whom were recruits/...

recruits and 195 non-recruits.

The results are presented, where appropriate, in the form of unbiased estimates of the means, standard errors, and 95% confidence limits, for the whole West Fife cohort of men. The words 'unbiased estimates', however, will henceforth be dropped in order to avoid ungainly repetition, although in all cases these words are implied. The number of degrees of freedom as calculated from equation (33) (p.112) for a stratified simple random sample, in which one stratum comprised a simple random sample of 29 men out of 195, and the other 33 men out of 33, is 28.

6.2. 1. Covariate Check on Non-Recruits

The 29 non-recruits interviewed were a simple random sample out of 195. Covariate checks of age and of town of residence showed that the sample was reasonably well balanced in both respects (Tables 20, 21). Men in the sample from Dunfermline are slightly under-represented whereas men from Lochgelly and Lumphinnans are slightly over-represented. Men born in the decade 1910 - 19 are also slightly under-represented in the sample.

6.2. 2. The Interviews

A mean number of 2.0 visits (SD 1.02) were required for a successful interview of each of the 62 West Fife men. The average interviewing time was 40.3 minutes (SD 14.4) but a further 7.2 minutes on average were spent in each man's home in general conversation and making enquiries about the whereabouts of his former colleagues at the Nellie/...

Nellie pit. After making log-transformations to normalise the results, the 95% confidence limits (CL) of the total time spent with each man in his home was 22.8 - 88.6 minutes.

6.2. 3. Occupational History

The employment status of the men at the time of interview is shown in Table 22. Although 9% were found to be unemployed, this figure, of course, underestimated the true unemployment rate since it included within the denominator of the calculation, men who had retired from work. An estimate of the unemployment rate among the ex-Nellie West Fife men was 12.7%. The 62% of men in employment did a wide range of work (Table 23). Although only 23.8% were still employed as coalminers, a further 9.3% were employed in other capacities within the coalmining industry. Thus 66.9% of the West Fife cohort had left the coal industry completely. Reasons for leaving the industry were revealing. Nearly half (47.3%) of the whole group had left on health grounds, and only 5.9% reached retirement age while still employed in coalmining (Table 24). Most men gave a history of working in the coal industry for many years, with ranges of 5 to 24 years for the recruits and 11 to 51 years in the case of non-recruits. The mean time in the industry for all 228 West Fife men at the time of interview was 32.8 years (SE 1.7; 95% CL 29.2 - 36.3 years).

A history of redundancy since leaving the Nellie pit was frequently elicited from the men, and in over a third of cases (37.6%) this had been occasioned by ill-health (Table 25). Over a third (35.1%), too, had had periods of unemployment of a year or more (Table 26).

Table 20: Town of Residence of West Fife Non-Recruits.

Town	Sample		All West Fife Non-Recruits	
	No.	%	No.	%
Ballingry	5	17.2	38	19.5
Blairhall	-	-	1	0.5
Cowdenbeath	3	10.3	16	8.2
Crossgates	-	-	1	0.5
Crosshill	1	3.4	9	4.6
Dunfermline	-	-	6	3.1
High Valleyfield	-	-	1	0.5
Hill of Beath	-	-	1	0.5
Inverkeithing	-	-	1	0.5
Kincardine	-	-	1	0.5
Lochore	1	3.4	11	5.6
Lochgelly	17	58.6	101	51.8
Lumphinnans	2	6.9	7	3.6
Oakley	-	-	1	0.5
	29	100	195	100

Table 21: Decade of Birth of West Fife Non-Recruits.

Year	Sample		All West Fife Non-Recruits	
	No.	%	No.	%
1890 -	2	6.9	7	3.6
1900 -	7	24.1	39	20.0
1910 -	5	17.2	47	24.1
1920 -	11	37.9	72	36.9
1930 -	4	13.8	30	15.4
	29	100	195	100

Table 22: Current Employment Status of West Fife Ex-Nellie Coalworkers.

	%	SE%	95% CL%
In employment	61.5	6.7	47.8 - 75.3
Retired from work	29.5	5.0	15.0 - 44.0
Unemployed	9.0	3.8	3.9 - 16.7

Table 23: Current Occupation of West Fife Ex-Nellie Coalworkers.

Occupational order		%	SE%	95% CL%
II	Coalminers (007,008)	23.8	6.0	11.5 - 36.2
VI	Electrical & electronic workers	2.9	2.7	0.4 - 8.5
VII	Engineering workers	3.8	2.7	1.3 - 9.4
XI	Clothing workers	2.9	2.7	0.4 - 8.5
XV	Construction workers	3.4	2.7	0.9 - 9.0
XVII	Drivers of stationary engines, cranes, etc.	6.8	3.8	1.8 - 14.5
XVIII	Labourers n.e.c.	6.3	3.8	1.3 - 14.1
XIX	Transport & communications workers	2.6	-	-
XXI	Clerical workers	2.9	2.7	0.4 - 8.5
XXV	Professional technical workers	5.9	3.8	0.9 - 13.6
	Not working	38.5		
		100		

Table 24: Reasons for Leaving the Coalmining Industry for West Fife Ex-Nellie Coalworkers.

	%	SE%	95% CL%
Still employed in coalmining	33.1	7.0	18.7 - 47.5
Reached retirement age	5.9	3.8	0.9 - 13.6
Left on health grounds	47.3	7.5	32.0 - 62.6
Left for other reasons	13.7	4.5	6.1 - 23.0
	100		

Table 25: History of Redundancy Among West Fife Ex-Nellie Coalworkers.

	%	SE%	95% CL%
Redundancy caused by:-			
ill-health	37.6	7.3	22.5 - 52.6
lack of jobs	21.6	6.0	9.3 - 34.0
other reasons	0.9	-	-
all reasons	60.1	7.2	45.3 - 74.9
No history of redundancy	39.9	7.2	25.1 - 54.7
	100		

Table 26: Length of Unemployment Among West Fife Ex-Nellie Coalworkers.

	%	SE%	95% CL%
Less than 1 month	3.8	2.7	1.3 - 9.4
More than 1 month but less than 1 year	21.2	6.0	8.8 - 33.6
1 year or more	35.1	7.2	20.3 - 49.9
	60.1		

6.2. 4. Functional and Symptomatic Health

Ten levels of functional health (Figure 9, 98-99) were identified among the men (Figure 17). Only a quarter (24.7%) were in optimal functional health. Over one third (35.1%) came into category AAB, in which functional health was impaired by limitations of walking. A further 15% were limited both in major activity and in walking and as many as 70.6%)(SE 6.4%; 95% CL 57.5 - 83.7%) had some limitation to mobility or walking (Table 27).

Over two thirds (67.3%) of the men admitted to some form of long-standing handicap which they attributed to mining. In some cases men had lost parts of their fingers or hand but they were able to adapt fully to new employment. This long-standing handicap, therefore, was not always severe enough to interfere with their functional health. Nearly one third (32.9%) had chest trouble which they attributed to mining and over a quarter (28.4%) had the sequelae of a mining accident; many (18.5%) had more than one type of disability (Table 28).

Long-standing handicap from all causes was present in 83.8% (SE 5.1%; 95% CL 73.3 - 93.9%), well in excess of the expected prevalence of chronic sickness of 28.6%, based on the age and sex specific rates for Scotland derived from the 1975 General Household Survey (GHS) (OCPS, 1978 b) and applied to the West Fife workers' age structure at the time of interview. Long-standing handicap which was also physically limiting to the men in its effect on their mobility or their ability to walk was present in 64.7% (SE 6.9%; 95% CL 50.6 - 78.8%). Cases/

Figure 17: Functional Health Levels Identified Among West Fife Ex-Nellie Coalworkers.

Scale	Function level
AAA	Optimum function.
AAB	Performed major and other activities, travelled freely, but walked with limitations.
ABB	Performed major and other activities, but travelled with difficulty, and walked with limitations.
CAA	Performed major activity with limitation, but travelled freely and walked freely.
CAB	Performed major activity with limitation, travelled freely, but walked with limitations.
CBB	Performed major activity with limitation, travelled with difficulty and walked with limitations.
DAA	Did not perform major but performed self-care activities; travelled freely and walked freely.
DAB	Did not perform major but performed self-care activities; travelled freely but walked with limitations.
DBB	Did not perform major but performed self-care activities; travelled with difficulty and walked with limitations.
DCB	Did not perform major but performed self-care activities; confined to house and walked with limitations.

Table 27: Functional Health Status of West Fife Ex-Nellie Coalworkers.

Scale	%	SE%	95% CL%
AAA	24.7	6.0	12.3 - 37.1
AAB	35.1	7.2	20.3 - 49.9
ABB	2.9	2.7	0.4 - 8.5
CAA	0.4		
CAB	15.2	5.6	3.6 - 26.7
CBB	3.4	2.7	0.9 - 9.0
DAA	4.3	2.7	1.8 - 9.8
DAB	7.7	3.8	2.6 - 15.4
DBB	3.4	2.7	0.9 - 9.0
DCB	2.9	2.7	0.4 - 8.5
	100		

Table 28: Prevalence of Long-Standing Handicap Resulting from Mining Among West Fife Ex-Nellie Coalworkers.

Handicap	%	SE%	95% CL%
1. Chest trouble	26.2	6.7	12.5 - 39.8
2. Sequelae of mining accident	16.2	5.1	6.1 - 26.7
3. Non-accidental back trouble	3.4	2.7	0.9 - 9.0
4. Non-accidental joint trouble	0.4	-	-
5. Other handicap	3.4	2.7	0.9 - 9.0
6. Combination of (1) and (2)	3.4	2.7	0.9 - 9.0
7. Combination of (1) and (3)	3.4	2.7	0.9 - 9.0
8. Combination of (2) and (4)	5.9	3.8	0.9 - 13.6
9. Combination of (1) and (4)	2.9	2.7	0.4 - 8.5
10. Combination of (2), (3) and (4)	2.9	2.7	0.4 - 8.5
11. No handicap attributed to mining	32.7	6.9	18.6 - 46.8
	100		

Cases in which such limiting long-standing handicap was directly attributed to work in the mines was present in 53.9% (SE 7.3%; 95% CL 40.4 - 70.4%). The standardised rate for limiting long-standing illness, using the 1975 GHS is 18.7%.

Symptoms of ill-health were even more prevalent, only 0.9% denying both long-standing handicap and symptoms. A total of 72.5% of the men (SE 6.7%; 95% CL 58.8 - 86.1%) had a long-standing handicap and/or symptoms which they attributed to mining. Only 0.4% West Fife ex-Nellie coalworkers were in optimal functional health, were without long-standing handicap and were symptom-free.

More detailed questioning in relation to respiratory symptoms revealed that serious symptoms were present in two fifths (40.6%) of cases; 24.5% (SE 6.7%; 95% CL 10.8 - 38.1%) had persistent cough and phlegm and breathlessness; 12.7% (SE 5.1%; 95% CL 2.6 -23.2%) had breathlessness but no persistent cough or phlegm; and 3.4% (SE 2.7%; 95% CL 0.9 - 9.0%) had persistent cough and phlegm but no breathlessness. A total of 63.1% (SE 7.1%; 95% CL 48.5 - 77.6%) were current smokers at the time of interview and only 19.1% (SE 5.6%; 95% CL 7.6 - 30.7%) had never smoked. Current cigarette smokers comprised 53.3% (SE 7.4%; 95% CL 38.1 - 68.5%). Applying age and sex standardised rates from the 1975 GHS for current smokers throughout Britain, the expected rate would have been 63.7%, and for current cigarette smokers in Scotland, 52.7%, both very similar to the figures obtained. Severe respiratory symptoms were not confined to current smokers; 6.8% (SE 3.8%; 95% CL 1.8 - 14.5%)/...

of the West Fife coalworkers had never smoked yet had severe respiratory symptoms and a further 5.9% (SE 3.8%; 95% CL 0.9 - 13.6%) who were ex-smokers also came into this category.

Alcohol consumption habits varied widely. Just over half (57.7%) drank regularly at least once a week, over a quarter (26.7%) took alcohol occasionally and the remainder (15.6%) were non-drinkers. These results are compared with the national Scottish drinking habits (Dight, 1976) in Table 29.

Table 29: Alcohol Consumption Habits Among West Fife Ex-Nellie Coalworkers.

	W.F. Workers			Scottish Males[1] Standardised For Age
	%	SE%	95% CL%	
Non-drinkers	15.6	5.6	4.1-27.2	7.3
Occasional drinkers	26.7	6.7	13.0-40.3	27.4
Regular drinkers	57.7	7.4	42.5-72.9	65.3
	100			100

1. Dight, S. (1976).

At the time of interview, over half the men were taking prescribed medicines (55.4%; SE 7.3%; 95% CL 40.4 - 70.4%). An expected 41.9% would have taken prescribed medicines in the previous two-weeks if the age-standardised values obtained by Dunnell & Cartwright (1972) in/...

in their 1969 survey were applicable.

Sixteen of the 62 men interviewed fulfilled the criteria for the confirmatory study, namely, that they had left the mining industry before retirement age because of ill-health which was both an impediment to their present functional health, and the consequence of their working in the mines. Six of the men were recruits and 10 were non-recruits. An overall estimate of West Fife men fulfilling these criteria is 32.1% (SE 7.1%; 95% CL 17.6 - 46.6%). All these men's hospital notes in Fife Hospitals, and in one orthopaedic hospital in Tayside, were examined, and all their GP's discussed their cases with me. Inat least 7 non-recruits and 3 recruits, the combined information from these sources confirmed that the men's present disability was largely, if not always wholly, the result of their work in the mines. An estimate, therefore, of the prevalence of confirmed cases of severe disability due to mining is 22.0% (SE 6.4%; 95% CL 8.9 - 35.0%). A noteworthy feature of this part of the investigation was the total absence of written communication to the GP from the NCB medical service concerning any of these men despite the fact that 10 of the 16 had been invalided out of the mines because of disability and at the time of interview were in receipt of an invalidity pension from the NCB. One other was invalided out and had received lump-sum compensation. In 5 of the men, the GP was unaware that his patient was suffering from a disability for which he had been discharged by the NCB.

6.2. 5. Health Service Use

All the men interviewed were registered under the NHS with a local/...

local general medical practitioner. Over 70% found that the surgery was conveniently situated and that the consulting times suited them (Table 30). Men/

Table 30: Convenience of Surgery and Consulting Times for West Fife Ex-Nellie Coalworkers.

	%	SE%	95% CL%
Situation and times convenient	71.6	6.7	57.9 - 85.2
Times inconvenient	14.4	7.1	4.4 - 25.0
Situation inconvenient	4.3	2.7	1.8 - 9.8
Situation and times inconvenient	9.7	4.5	2.2 - 19.0
	100		

Men who experienced difficulty in walking, however, tended to find the situation inconvenient. This applied particularly to those with chest trouble living in hilly parts of the area. Nearly a quarter (24.1%) found the consulting hours inconvenient. In all cases this occurred because men had to take time off work and lose wages in order to fit in with GPs' consulting hours.

The most recent medical encounter was with a GP in 92.8%. The remainder had seen a medical officer at their place of work (6.8%) or a hospital consultant in the outpatient department (0.4%). Home visits accounted for 12.7% of contacts and 80.1% were at the GP's surgery (Table 31). All the contacts with medical officers at work/...

work and hospital consultants were by appointment. Some GPs in the area operate appointment systems and some do not. This policy decision largely determined whether the GP contact at the surgery was by appointment or not.

Table 31: Most Recent Patient-Doctor Consultation for West Fife Ex-Nellie Coalworkers.

	%	SE%	95% CL%
GP at surgery	80.1	6.0	67.7 - 92.5
GP on home visit	12.7	5.1	2.6 - 23.2
Medical Officer at work	6.8	3.0	1.8 - 14.5
Hospital Consultant	0.4	-	-
	100		

The most recent doctor-patient contact had occurred within the previous 4 weeks in 38.6% (SE 7.2%; 95% CL 23.8 - 53.4%), between 4 weeks and 1 year previously in 43.3% (SE 7.3%; 95% CL 28.2 - 58.3%), and more than 1 year before in 18.1% (SE 6.0%; 95% CL 5.8 - 30.5%). Just over a quarter (27.5%; SE 6.7%; 95% CL 13.9 - 41.2%) had consulted a GP in the two weeks preceding the interview, a figure well in excess of the expected value of 11.1% for men of that age in Scotland in the 1975 GHS. The men had an average number of 0.54 contacts with a GP in the previous two weeks (SE 0.21; 95% CL 0.14-0.98) and 0.89 in the last four weeks (SE 0.27; 95% CL 0.34 - 1.4). Extrapolating from the latter figures, each man had an estimated/...

estimated 11.6 consultations with a GP each year. The age-standardised figure for all men in Scotland in the 1975 GHS is 4.0. There were many causes for contacting their GP: 7.2% of men (SE 3.8%; 95% CL 2.2 - 15.0%) had respiratory infections and the remaining 20.3% (SE 6.0%; 95% CL 8.0 - 32.7%) had other non-communicable diseases.

A substantial proportion of the 92.8% of men whose last medical contact was with a GP had some complaint about the encounter. The most common was the lack of an explanation about their problem (27.1%). One man who went to this GP with pains in his knees was told "to grin and bear it". Another commented,

"My pulse was going about 120 to 130 but they don't give you much information. He gave me tablets."

General dissatisfaction with the interview was also common (15.6%). One old miner with chest and heart disease and arthritis said,

"I don't like the constant changing of tablets. I told the doctor I'm being made a guinea pig."

Another had chronic cough with sputum and exertional dyspnoea on level ground. In addition he was on three different kinds of medication. Asked the reason for his lack of satisfaction, he explained,

"The doctor has never sounded or examined me."

Appointment systems gave rise to 13.6% of complaints. Some men (10.6%) said that their GPs did not devote enough time to the consultation.

"He can't get you out of the surgery quick enough",

was how one ex-miner described it. A few (4.7%) whose GPs had no/...

no appointment systems complained about the length of time they had to wait at the surgery before being seen. One related the following story:

"I had to sit till all the other patients had been seen. I was in pain with piles and my back."

Overall, 41.1% had some complaint to make (Table 32). It/

Table 32: Complaints About GP Consultation By West Fife Ex-Nellie Coalworkers in Whom This Was Their Last Medical Contact.

Last medical contact	%	SE%	95% CL%
Medical officer/consultant	7.2	3.8	2.2 - 15.0
GP	92.8	3.8	85.0 - 97.8
- no complaints	51.7	7.5	36.4 - 67.0
- some complaints	41.1	7.3	26.0 - 56.1
- too long to wait for appointment	13.6	5.1	3.5 - 24.1
- too long to wait in the waitingroom	4.7	2.7	2.2 - 10.3
- inadequate time spent on the consultation	10.6	4.5	3.1 - 19.9
- lack of explanation of their problem	27.1	6.7	13.4 - 40.8
- dissatisfaction with the consultation	15.6	5.6	4.1 - 27.2

It should not be assumed that all 51.7% without complaints had good grounds for this view. One man professed satisfaction with his last consultation because there was "nothing else you can do". However, very many men spoke about their GPs with great admiration and respect and were obviously satisfied with their work. One elderly satisfied ex-miner spoke about his GP in the following glowing manner:

"I can't manage to the surgery. The doctor always comes to see me. He's like an army sergeant-major and makes me take my tablets."

Within the previous four weeks 11.0% (SE 4.5%; 95%CL 3.5 - 20.3%) had consulted other health workers, most frequently an optician (6.3%; SE 3.8%; 95% CL 1.3 - 14.1%), but also a nurse (3.8%; SE 2.7%; 95% CL 1.3 - 9.4%) and a dentist (0.9%). Other health services were utilised by 15.2% (SE 5.6%; 95% CL 3.6 - 26.7%). Most commonly this was a centre for the elderly (8.8%; SE 4.5%; 95% CL 1.3 - 18.2%), followed by a home help (5.9%; SE 3.8%; 95% CL 0.9 - 13.6%), and an ambulance (0.4%). Many men (22.1%; SE 6.0%; 95% CL 9.7 - 34.5%), however claimed they would have used some aspect of the health services if these had been more accessible. The most frequently expressed wish was for a consultation with a doctor and some had more than one service they wished to use (Table 33).

A total of 29.2% (SE 6.9%; 95% CL 15.0 - 43.3%) spent part or all of at least 1 day in bed in the previous two weeks on health grounds. This compares with an expected value based on the 1975 GHS of 7.7%. The men spent an average of 1.6 days in bed on health grounds during this time (SE 0.4; 95% CL 0.8 - 2.4 days). Within the/...

the previous twelve months, 7.2% (SE 3.8%; 95% CL 2.2 - 15.0%) were admitted as inpatients to hospital. The actual numbers involved proved inadequate for more detailed analyses.

None of the men had been in touch with their local health council in the last year. Nor had any man made contact with a voluntary organisation on any health matter during this time. Indeed, few men knew of the existence or functions of either of these. However, 15.7% (SE 5.1%; 95% CL 5.7 - 26.3%) had consulted workers connected with the environmental health services in the preceding twelve months. In 3.8% (SE 2.7%; 95% CL 1.3 - 9.4%) this contact was with an environmental health officer. Most frequently, however, this contact was with an official dealing with health and safety at work (9.0%; SE 3.8%; 95% CL 3.9 - 16.7%). A small proportion (2.9%; SE2.7%; 95% CL 0.4 - 8.5%) had been in contact with the Regional Council's Social Work Department. No one was satisfied with the Environmental Health Department. Typical comments included,

"We had water flooding. The drains were broken and not working in the garden but nothing was done about it."

and,

"We had rats where the dustbins are three months ago. We've still got the problem."

All the men who had come into contact with health and safety inspectors had done so while at work in the coalmines or at Rosyth naval dockyard, near Dunfermline. Whereas dockyard workers were generally satisfied with the handling of health and safety matters/...

matters, ambivalent attitudes could be detected among working miners. One complained that there was "too much red tape", and claimed that health and safety measures in the mines were too stringent to do the work efficiently. Most miners felt that the situation was satisfactory but all those who disagreed had the same complaint to make:

"Inspectors phone about three days in advance to arrange an inspection", commented one miner. Another noted,

"We always know in advance when the inspectors are coming and we can't do anything about it".

The impression among dissatisfied miners was that safety regulations had a low priority for much of the time. The advance notice gave time to put things in order, only for them to deteriorate again after the visit by the Mines' inspectors. Men felt inspections carried out without notice would give a better impression of day-to-day environmental conditions at work.

Table 33: Proportion of West Fife Ex-Nellie Coalworkers Who Would Have Made Use of Certain Health Service Facilities Had These Been Available or More Readily Accessible.

	%	SE%	95% CL%
Consultation with a doctor	15.9	5.1	5.7 - 26.3
Chest X-ray	2.9	2.7	0.4 - 8.5
Meals on wheels	2.9	2.7	0.4 - 8.5
Centre for the elderly	2.9	2.7	0.4 - 8.5
Consultation with a nurse	0.4	-	-
Dental treatment	0.4	-	-
Physiotherapy	0.4	-	-

6.2. 6. General Amenities and Economic Level

All interviewed men lived in houses rented unfurnished from Dunfermline District Council or the Scottish Special Housing Association. All had an inside toilet, a hot water supply and a fixed bath or shower. Just over half (52.6%; SE 7.5%; 95% CL 37.3 - 67.8%) had some central heating, although only 31.0% (SE 6.7%; 95% CL 17.4 - 44.7%) had fully centrally heated homes. Half of the houses (51.3%; SE 7.5%; 95% CL 36.0-66.5%) had telephones. In the 1975 GHS, 47% of households in Britain had some central heating and 52% had a telephone. Overcrowding was common, 28.8% of men living in homes with one or more room less than the bedroom standard. This figure was well above the 4% of households throughout Britain found to be overcrowded in the 1975 GHS (Table 34). One interviewee declined to supply information about his income. The average gross weekly income of all the men, including those who had retired or were unemployed was £55.59 (SE £3.04; 95% CL £49.34 - £61.84).

6.3. The Health of the Nellie Recruits

Fifty-six men who were born after 1/1/36 were working at the Nellie Pit on 1/10/55. One died at the age of 17 from a cerebral abscess. Thirty-nine of the remainder were thought by Fife Area Health Board to be resident in Fife, but 2 of these, after enquiries, were found to be living and working out of Scotland. All the men were aged 37 to 42 at the time of interview.

In this section the results of an investigation into the health of the 37 recruits found to be alive in Fife is presented. All/...

Table 34: Proportion of West Fife Ex-Nellie Coalworkers, and All Households in Britain Living Above and Below the Bedroom Standard.

Bedroom standard	West Fife ex-Nellie coalworkers			All households Great Britain [1]
	%	SE%	95% CL%	%
Two or more above	6.3	3.8	1.3 - 14.1	23
One above	38.5	7.3	23.4 - 53.5	40
Equal to	26.3	6.4	13.3 - 39.4	33
One below	25.9	6.4	12.8 - 39.0	4
Two or more below	2.9	2.7	0.4 - 8.5	-
	100			100

1 GHS 1975 (OPCS, 1978 b)

All were successfully interviewed.

6.3. 1. Presentation of Results

Since this is not a sample of all recruits, but a selection, standard statistical treatment of the results is inappropriate as a means of making generalisations. However, it is possible to complete extreme values for proportions on the assumption that all or none of the recruits resident outwith Fife had the characteristic. These possibilities are shown in Table 35.

6.3. 2. The Interviews /

Table 35: Extreme Possibilities of Proportions For All Recruits For Given Proportions Among Fife Recruits.

Proportion deserved in Fife Recruits %	Extreme Possibilities for all ex-Nellie Recruits %
0	0 - 33
5	3 - 36
10	7 - 40
20	14 - 46
30	20 - 53
40	27 - 60
50	34 - 66
60	40 - 73
70	47 - 80
80	54 - 86
90	60 - 93
100	67 - 100

6.3. 2. The Interviews

A mean number of 2.1 visits (SD 1.06) were required for a successful interview. The average interview time was 39.2 minutes (SD 15.2) and the total time spent in each man's home was 47.0 minutes (SD 18.0). The 95% CL of the total time (after log-transformation to normalise the results) spent in the house with each recruit was/...

was 20.3 minutes to 94.8 minutes.

6.3. 3. Occupational History

All the recruits had worked as coalminers on the face at the Nellie. None had been engaged in other trades within the mining industry while at the Nellie. At the time of interview 81% had jobs, and 19% were unemployed. Only 41% were still employed as coalminers (Table 36), with a further 5% unemployed whose last occupation was coalmining. A total of 44% were still working within the coal industry, but only 27% of all interviewed recruits were still face-workers (Table 37). The mean number of years spent in the industry at the time of interview was 15.3. Applying life-table methods for incomplete follow-up data, an estimate of the half-life, or median time, for a worker remaining in the coal industry from date of recruitment is 18.5 years (Table 38). This contrasts with the expected total working life of males aged 19 in Great Britain in 1955 of 44.6 years (Ministry of Labour and National Service, 1959). Ill-health accounted for 19% of men who left coalmining, although the most commonly advanced reasons included leaving for better working conditions elsewhere (22%) and worry about the long term health prospects (22%). Many men gave more than one reason (Table 39).

A period of redundancy since leaving the Nellie was a common experience; 46% had had some unemployment. In 27% this resulted because no jobs were available, in 16% ill-health was the most important factor, and in the remaining 3%, unemployment arose for other reasons. In only 5% was the period of unemployment less/...

less than one month, in 22% it was between one month and one year, and in the remaining 19% it was for longer than one year.

Table 36: Employment Status and Current or Last Occupation of Ex-Nellie Recruits.

Occupational order		Employed %	Unemployed %	Total %
II	Coalminers	41	5	46
III	Gas, coke and chemical makers	3	0	3
VII	Engineering workers	5	0	5
XIV	Makers of other products	3	0	3
XV	Construction workers	3	3	5
XVII	Drivers of stationary engines, cranes, etc.	5	3	8
XVIII	Labourers n. e. c.	5	3	8
XIX	Transport and communication workers	16	0	16
XXIII	Service, sport and recreation workers	0	3	3
XXV	Professional and technical workers	0	3	3
		81	19	100

Table 37: Employment Status and Occupation of Ex-Nellie Recruits Whose Present or Most Recent Occupation was in the Coalmining Industry.

Occupation	Employed %	Unemployed %	Total %
Face-workers	27	0	27
Other workers underground	11	0	11
Surface workers	3	5	8
Workers in other occupational orders	3	0	3
	44	5	49

Table 38: See Over Page.

Table 39: Reasons Given by Ex-Nellie Recruits for Leaving the Coal Industry.

	%
Still working in the coal industry	43
Left on grounds of ill-health	19
Left for other reasons	38
- left for better working conditions elsewhere	22
- worried about long term health	22
- pressure from wife	8
- witnessed serious accidents	5
- left for better wages elsewhere	5
- felt employment prospects were insecure	3

Table 38: Life Table Showing Number of Recruits in the Coal Industry (n), Number Leaving (d) Probability of Remaining (p), and Proportion Remaining At the Start of the Year (l_i).

Years after recruitment	n_i	d_i	p_i	l_i	$SE(l_i)$
0	37				
4	37	1	0.973	100.0	
5	36	2	0.944	97.3	2.666
6	34	1	0.971	91.9	4.487
7	33	5	0.848	89.2	5.105
8	28	1	0.964	75.7	7.053
9	27	0	1.000	73.0	7.301
11	27	1	0.963	73.0	7.301
12	25	3	0.880	70.3	7.514
13	21	0	1.000	61.8	8.036
15	20	1	0.950	61.8	8.036
16	19	2	0.895	58.7	8.208
17	15.5	0	1.000	52.6	8.428
18	14	1	0.929	52.6	8.428
19	13	1	0.923	48.8	8.622
20	12	0	1.000	45.1	8.738
21	12	1	0.917	45.1	8.738
22	11	0	1.000	41.3	8.779
23	8.5	1	0.882	41.3	8.779
24	3	0	1.000	36.4	8.991

6.3. 4. Functional and Symptomatic Health

Eight levels of functional health (Figure 9, p. 98-99) were identified among the ex-Nellie recruits (Table 40).

Table 40: Functional Health Status of Ex-Nellie Recruits.

Scale	%
AAA	54
AAB	16
CAA	3
CAB	3
CBB	3
DAA	8
DAB	11
DBB	3
	100

Only 54% were in optimal functional health although 68% had some long-standing handicap. In 58%, men attributed long-standing handicap to their work in the mining industry (Table 41). The expected prevalence of long-standing illness for men of this age in Scotland according to the 1975 GHS is 11.7%. Long-standing handicap which physically limited the men's ability to travel or walk freely was prevalent in 35%, and such a handicap resulted from mining in 32% overall. Some men in this group whose disability was attributed to/...

to mining had more than one handicap, and the prevalence from various causes was chest trouble 16%, sequelae of mining accident 14%, non-accidental back trouble 5%, and other handicap 3%. The 1975 GHS reports limiting long-standing illness in 5.4% of men in Scotland aged 15 - 44. Only 11% of the recruits were without symptoms of ill-health at the time of interview, and only 3% were in optimal functional health, without long-standing handicap and symptom-free.

Table 41: Prevalence of Long-Standing Handicap Resulting From Mining Among Ex-Nellie Recruits.

Handicap	%
1. Sequelae of mining accident	30
2. Chest trouble	11
3. Non-accidental back trouble	3
4. Non-accidental joint trouble	3
5. Other handicap	3
6. Combination of (1) and (2)	5
7. Combination of (2) and (3)	3
8. No handicap attributed to mining	42
	100

Among/

Among those still employed in the mining industry 69% were in optimal functional health and 43% of the men who had left mining were in this state. This difference, however, did not reach conventional levels of statistical significance,

$(\chi^2_c = 1.04 \; ; \quad 0.3 > p > 0.2)$.

Severe respiratory symptoms due to mining were present in 11%; 5% had cough, phlegm and dyspnoea, 3% had cough and phlegm but no dyspnoea and another 3% had dyspnoea but no cough or phlegm. All had left the industry on health grounds. Half of these were current smokers and half had never smoked.

Throughout the recruits, smoking was less common than in men of the same age throughout Scotland (Table 42). Alcohol consumption, too, was less common than in men in Scotland of the same age (Table 43).

Table 42: Current Smoking Habits of Ex-Nellie Recruits and Men in Scotland.

	Recruits	Men in Scotland aged 35 - 49 in 1975[1]
	%	%
Current smokers	51	57
Ex smokers	19	22
Never smoked	30	21
	100	100

1 GHS 1975 (OPCS, 1978 b)

Table 43: Current Drinking Habits Among Ex-Nellie Recruits and Men in Scotland.

	Recruits	Men in Scotland of same age[1]
	%	%
Non drinkers	5	3
Occasional drinkers	22	15
Regular drinkers	73	82
	100	100

1 Dight (1976)

On the day of interview 32% were taking a prescribed medicine. In 1969 Dunnell and Cartwright (1972) found that 36% of men of this age had taken prescribed medicine during the two week period before the interview.

6.3. 5. Confirmatory Study

Six ex-Nellie recruits (16%) said that they had left the industry on grounds of ill-health resulting from coalmining, and were still incapacitated to some extent by it. Their case histories are presented here as they raise several points of general interest.

Case 203. This 39 year old man left school when he was 14 and immediately entered the Nellie pit. In August, 1956, 3 years after becoming a coalminer, he sustained an injury to his right knee while working underground. A torn medial meniscus was confirmed in/...

in hospital and at operation in December of the same year, the torn meniscus and a torn anterior cruciate ligament were excised. Less than a year later he had another injury at the pit to the same knee necessitating the removal of a badly torn right lateral meniscus in August, 1957. He was discharged from the mines the following year on health grounds and in 1963, following further trouble with his right knee, an X-ray confirmed "well-marked osteoarthritic changes". In 1965 he returned to face-work in the mines, but had to leave a year later when he was admitted to hospital for exploration of the knee and removal of osteophytes. In 1969, a medical tribunal noted that he had "a good deal of osteoarthritis in his right knee. He would do well at a job not involving kneeling or walking over rough ground." In 1975 he was again admitted for removal of osteophytes. In 1971 he found employment as a slinger outside the coal industry but at the time of interview he had been unemployed for a year and was in receipt of an industrial disablement benefit. His functional health status was DAB and his major disabilities were in finding a suitable job, and in walking any distance or in climbing stairs. His GP confirmed that his knee trouble was the direct result of mining but commented that, whereas men in other occupations might well manage with a similar problem, the rigours of mining made adaptation extremely difficult, if not impossible.

Case 208. This 38 year old man entered the Nellie pit on leaving school at the age of 14 in 1953. In 1967 he was admitted to hospital with a chest infection and told he had bronchitis. A chest X-ray showed only "slight increase in lung markings". In the following/...

following year he was invalided out of the mines because of his chest, and awarded an invalidity pension. Since that time he had worked as a labourer. In 1969 his GP treated him for bronchitis and a chest X-ray showed "a little prominence of the general lung markings". In February, 1977, he was again treated by his GP for bronchitis and in October of the same year, when he was admitted to hospital with a bleeding duodenal ulcer, it was noted that he had scattered coarse crepitations on auscultation. His functional state of health was AAB, his chest trouble reducing the distance and speed he could walk and hindering him from ascending hills. He had a persistent chronic cough, phlegm and dyspnoea on level ground which forced him to walk more slowly than other people. He had never smoked at any time in his life. There was no correspondence from the NCB medical service in his notes. On questioning, his GP denied that his man's bronchitis had any significance to his leaving the mines. Rather, he felt that he and many others "manipulated the situation to get out of the pits".

Case 218. This man first developed bronchitis in 1961, 9 years after entering the mines at the age of 15, and finally left because of chest trouble in 1968. At that time he was noted in hospital to have rhonchi throughout his chest. Chest X-ray in 1969 noted "a slight generalised increase in lung markings". For the last 2 years he was unemployed, but worked as a labourer for 4 years prior to that. His functional health status was DAB and he had a chronic persistent cough with sputum throughout the whole year which reduced his walking speed and gave him dyspnoea on climbing hills. He/...

He admitted to smoking 10 to 15 cigarettes a day, and said he became easily depressed and weepy. This latter problem he attributed to his being out of work. His GP, however, formed an entirely different opinion, denying any existence of a chest problem, and expressed the opinion that he was a "born malingerer".

Case 226. Only 4 years after entering the Nellie pit in 1955 at the age of 15, this man was involved in an underground accident. A runaway bogey crushed his left arm and this put him off work for 6 months. In 1961 a girder fell on the same arm while underground, and he sustained a fracture of the left lunate. The fracture did not unite, and he required a series of operations which resulted finally in an arthrodesis in 1964. He was discharged from the mines in 1961 and an Industrial Injuries Board awarded him a 35% pension for life. In 1965 he secured re-employment in the mines but continuing pain in the wrist, the onset of severe bronchitis and the development of a hiatus hernia caused the NCB to invalid him out again in April, 1977. He had never smoked in his life but had a chronic persistent cough and sputum, and dyspnoea on level ground. He was on a steroid inhaler and antibiotics more or less continuously and his functional health status was DAB. His GP felt his major problem was chronic bronchitis due mainly to the mines, but exacerbated by obesity and his mental make-up.

Case 228. When he was 27, some 10 years after entering the mines in 1955, this man injured his right knee while working underground. He required excision of both menisci and had to leave the mines a year/...

year later. For 11 years now he had worked as a slinger in another industry. His functional health status was CBB, his knee still causing him difficulty in getting around and walking, and forcing him to have rest periods at work. In the last 4 years he had recurrent illnesses not directly attributable to mining, including eye trouble, viral pericarditis and cirrhosis of the liver. His GP felt that the cartilage trouble was entirely due to mining but that the man's most pressing current problem was his liver cirrhosis.

Case 231. This man entered the Nellie pit straight from school in 1955 when he was 15 but left 4 years later to join the army. In 1962 he received an injury to the right knee while in the army, and developed a chondromalacia patellae which required synovectomy in 1964. He was discharged from the army in the same year. After working in a factory for 6 years, he re-entered the mines in 1970, but a combination of illnesses made work impossible. He developed ataxia in the dark in 1972 and was admitted to hospital for investigation of his vestibular function. Furthermore, he developed chronic persistent cough and phlegm, and dyspnoea on level ground, and he had an exacerbation of his knee trouble. Although his GP noted in the referral letter to the orthopaedic surgeon that he had an old knee injury during army service and he "makes the most of it", the consultant was of the opinion that, "This boy has an osteoarthritis of his patella so severe and so long lasting that I think it is unlikely that anything will help him except patellectomy." Patellectomy was performed in 1976 2 years after he was invalided out of the mines on an NCB pension. Since that time he was unemployed. He smoked 10/...

10 cigarettes per day and his functional health was DBB. His GP felt his knee trouble was unrelated to his mining history and denied all knowledge of chest trouble. The GP also believed that "he is like his father and brothers - lazy, and does not want to work." Again, there was no correspondence from the NCB medical service to the GP in his notes.

Thus 4 men, or 11% overall (cases 203, 208, 226, 231) were in receipt of industrial disablement benefit or an NCB pension and had been discharged from the mines on health grounds. The GPs confirmed that 2 of these men (203, 226), or 5% overall, and 1 other (228), making a total of 8% overall had suffered their ill-health as a direct consequence of working as coalminers. In 2 cases (208, 231) in receipt of a pension, the GP disagreed both with the men and with the apparent assessment of the NCB medical service. In the final case (218) there was no corroborative evidence in support of the ex-miner's claim and his GP not only denied that his present state of health was the consequence of mining but completely rejected any idea that he had any ill-health at all. It is interesting to note that none of the recruits with severe respiratory symptoms (208, 218, 226, 231) had any record of referral to a chest physician, or of lung function tests, although all 4 may have chronic destructive bronchitis.

In summary, 16% of miners claimed they had continuing severe disability as a result of mining; 5% were confirmed both by the GP and apparently by the NCB; 11% overall were in receipt of an NCB pension or injury/...

injury benefit because of ill-health; 8% overall were confirmed by their GP to have ill-health attributable to mining; in 14% there was apparent confirmation either from the GP or from the NCB that they had ill-health resulting from their work.

6.3. 6. Health Service Use

It was felt by 35% that the GP's surgery was in some way inconvenient, 19% complaining about the consulting times, 11% about its location, and 5% about both. The situation of the surgery was particularly important to those with difficulty in travelling and walking, and the consulting times were relevant to those with jobs. Men frequently complained that they could lose a half day's work, or sometimes even a whole shift, by attending their GP's surgery, a situation which resulted in obvious financial loss. The last medical contact for 87% was with a GP at the surgery, 5% had had a home visit by a GP, 5% had seen a medical officer at work, and the remaining 3% had attended a consultant's outpatient clinic in hospital. Although the figures are not strictly comparable, 91% of all people in Britain aged 15 - 44 interviewed for the GHS, 1975, who had had a consultation with a GP in a 2 week reference period had consulted him at his surgery, and 8% had had a home visit.

In 38% of the recruits this last medical consultation was within the previous 4 weeks, in 51% between 1 month and 1 year previously, and in 11% it was over a year before. Nearly a quarter (24%) had consulted their GP in the two weeks preceding the interview, a figure well above the expected proportion of 11.5% for men aged/...

aged 15 - 44 in the GHS, 1975. The reasons for this consultation varied, bronchitis 5%, duodenal ulcer 5%, and 3% each for retrosternal pain, haematuria, septic arm, a psychiatric condition, and an upper respiratory tract infection. These men had a total of 21 consultations with their GP in the 4 weeks prior to the interview, giving an estimate of 7.4 GP consultations per person per year. The Scottish average for men of this age was 3.0 per year in the GHS, 1975.

In the 92% of cases where the last consultation was with their GP, over one-third (38%) had some complaint about the encounter. In 22%, the men received no explanation about their problem, 11% each had too long to wait for an appointment, too long to wait in the waiting room, and inadequate time on the consultation, with 5% expressing dissatisfaction with the interview. Some men had several complaints (Table 44).

In the 4 weeks preceding the interview, 8% had consulted a dentist, 5% a nurse and 3% an optician, 3% had also used an ambulance. Many (32%) would have used the health services had they been more readily available; the services of an optician in 3%, a nurse to dress a wound in 3%, physiotherapy in 3%, an examination by a doctor in 16%, and medical advice from a doctor in 11%. Some would have used more than one service.

During the two week period before the interview, 16% spent part or all of at least one day in bed because of ill-health compared with/...

with 8.4% of men in Scotland of this age who reported restricted activity in a corresponding period in the 1975 GHS. An estimate of the average number of days at least part of which was spent in bed due to ill-health, per man per year was 23.9. The 1975 GHS estimated the average number of restricted activity days per person per year in Scotland among men of this age to be 14.5.

Table 44: Complaints About GP Consultation By Ex-Nellie Recruits In Whom This Was Their Last Medical Contact.

Last medical contact	%
Medical officer/consultant	8
GP	92
- no complaints	54
- some complaints	38
- too long to wait for appointment	11
- too long to wait in waitingroom	11
- inadequate time spent on consultation	11
- lack of explanation of their problem	22
- dissatisfaction with the consultation	5

Within the previous year 24% had been in contact with Health and Safety Inspectors at work. Several men (8%) were either part-time workmen's inspectors in the mines or were serving on safety committees. Complaints about advance warning of inspectors' visits were made by 5% of the men. Of the 5% who had been in touch with environmental health/...

health officers in the previous year, none felt that their problems had been dealt with adequately. None had had any contact with the Local Health Council or a voluntary body within this time.

6.3. 7. General Amenities and Economic Level

Nearly all the men (97%) lived in unfurnished houses rented from the district council, with 3% living in their own home. All the houses had inside flush toilets and a fixed bath or shower with hot water supply. Just over half (51%) had some kind of central heating, and in 46% this was full central heating; 51% had a telephone. Throughout Britain in 1975, 47% had some central heating and 53% had a telephone (OPCS, 1978 b). Over a third (35%) were living in homes with 1 or more bedroom below the standard compared with the national figure in Britain of 5% (Table 45).

All the men provided details of their income. The average gross weekly income at the time of interview was £73.51 (SE £4.20; 95% CL £64.99 - £82.04). In April, 1976, the average gross weekly earnings for all men in Fife aged 21 and over in full-time employment whose pay was not affected by absence was £70.9 (SE 1.7%). The corresponding figure for the whole of Scotland was £71.60 (SE 0.5%) (Scottish Office, 1978). A total of 51% of ex-Nellie recruits were earning less than this latter figure at the time of the interview in February, 1978.

Table 45: Proportion of Ex-Nellie Recruits, and All Households in Britain Living Above and Below the Bedroom Standard.

Bedroom standard	Recruits	All households in Britain[1]
	%	%
Two or more above	3	23
One above	19	40
Equal to	43	33
One below	35	4
Two or more below	0	1
	100	100

1 GHS 1975 (OPCS, 1978 b)

7. Discussion.

7.1. Health

Before embarking on a discussion of this investigation, I should like to reiterate the concept I hold to be fundamental to the idea of health developed in Chapter 2. Its lynch-pin is the WHO definition of health, and so it follows that those unable to accept this definition will find my treatment of this subject unacceptable. I have also emphasised that within this holistic view of health it is crucial to adopt a practical rather than an abstract approach when assessing a person's health status. This assessment should be applicable to persons in real situtations, and capable of evaluating health not only in terms of the ability of each individual to function in society but also within the context of our efforts to improve it. Furthermore, I have contended that dialogue between health workers and the public must be seen as an essential element both of our attempts at measuring health status and of the decision-making process on the implementation of health-promoting activities.

In order to demonstrate how this approach to health can work in practice, the health of a coalmining community in Fife has been investigated.

The study, however, is not without its weaknesses. First, although the assessment of health in functional terms seems an advance, it must be acknowledged that its measurement remains unduly biased towards the physical and social aspects to the detriment of its mental component. Secondly, circumstances dictated that the/...

the assessment developed could only be applied to the small group of 16 men whose hospital records were examined and whose case histories were discussed with GPs. Moreover, this weakness in the method of investigation remains in spite of the fact that the men whose GPs were interviewed were likely to be of most interest and relevance to the study. Indeed, by accepting the assessments of men who felt their ill-health had not resulted from mining and hence did not fulfil the criteria of the confirmatory study, and by apparently minimising the mental component of health, the method adopted may have underestimated the prevalance of ill-health or degree of morbidity which can be attributed to the effects of the mining industry. Notwithstanding these weaknesses I believe the overall approach of the investigation to be fundamentally sound.

7.2. Epidemiological Considerations

The magnitude of the task of tracing a cohort of 427 coalworkers 22 years after they were all employed at the same coalmine should not be underestimated, especially since the basic data were only names and dates of birth. Furthermore, the mine had been closed for over 12 years and the effect of this on migration was an added difficulty. Using standard epidemiological techniques it was possible to determine the vital status of 92% of the men. By interrogating surviving members of the cohort themselves sufficient additional information was gathered to classify the vital status of the whole cohort (100%). Cross-checking this against death registration data and health board records confirmed the vital status of 97%, or 98% if emigrants are included to their date of/...

of embarkation. The quality of the information supplied by the mineworkers on the remaining 2% is much more open to question. However, judging by their information on those who died, one can be reasonably confident it was no less accurate than that derived from NHS sources. These results compare favourably with those of Jacobsen (1977). In an elaborate study of coalminers' mortality he was able to trace 96% of a cohort of 48,000 British coalminers followed up for 14 to 18 years by using NHS, NCB and National Insurance data.

One question arises immediately from this study: is it valid to commence an epidemiological investigation such as this purely from a list of names and dates of birth obtained from a trade union official? Such a non-conformist approach seemed certain to encounter problems, one of which was the inclusion in the list of one man who had died over a year previously. Another stemmed from the possible bias introduced by the removal of names when the sheets were torn and disfigured in use. However, these difficulties do not seem major ones when measured against the potential benefit of utilising a new source of data. Clearly, before the technique could be extended the exact circumstances would require careful evaluation; the nature of coalmining and the 'closed-shop' in the industry were obviously favourable factors here. Nevertheless it should be possible in principle to construct similar sampling frames for any unionised industry in which a 'closed shop' exists. Fishing and farming may be among the few remaining non-professional occupations with sociological features as distinct as mining. Both/...

Both tend to recruit young men and the work often becomes more a way of life than simply a job; both are performed in environments which at times are not only unpleasant but dangerous; both have appalling accident rates; workers in these industries also tend to live in communities apart from most other industrial workers. However, the fishing and farming communities differ from that of mining in that a large number of separate employers are involved and neither is fully unionised. The probability of obtaining a suitable sampling frame of recruits into these industries is therefore less likely. It is for these reasons that the methods used in this investigation might be less successful if applied to farm workers and fishermen.

The problems associated with the heterogeneous age structure of the Nellie cohort and the variable follow-up period were effectively solved using actuarial techniques. However the quality of some of the survival data is unknown. When 23 of 70 men said by the NHSCR to be alive were independently checked, 4 (17%) were found to have died. No attempt was made to check the accuracy of the data on the other 47 said by the NHSCR to be alive in Britain or overseas. If this information was as accurate as the previous data, 8 may have died. The 95% confidence limit of this is 13, 4% of all the cohort classified as alive. This again is similar to the findings of Jacobsen (1977) who estimated that up to 3% of men classified alive in his study may in fact have died. It does however put into question the validity of the comparative mortality data of this present study. Although none of the differences in/...

in Table 13 was found to be significant at the 5% level, cohort mortality was lower than expected. If, as appears likely, cohort mortality has been underestimated by up to 13 deaths, the true situation must be that the mortality experience of these men (Table 13) still differs little from that of other men in Britain of the same age. However the effect of this potential source of error on cause-specific mortality comparisons (Table 15) is much more problematic. The higher cohort mortality from pneumoconiosis would clearly be unaffected but it would require only 3 additional deaths from ischaemic heart disease to nullify at the 5% significant level the cohort's apparent advantage in this condition. The cohort also experienced more deaths from cerebrovascular disease but this was only significant for men of working age in England and Wales. The interpretation and overall, as opposed to statistical, significance of additional cohort deaths from this condition is far from clear. Because of its potentially large error, and because the study covers a long period of time during which national and regional death rates are known to have changed, all the mortality data should be treated with great circumspection. Furthermore two considerations should be constantly borne in mind. In the first place, generalisations must be treated with caution in any investigation dealing with a highly selected cohort which included only coalworkers working at one particular time in a single coalmine from one region of the British coalfields. Secondly, this study involved not a cohort of coalminers but of coalworkers, a fact that is particularly relevant to interpretation of death certificate occupational data (Tables 17, 18, 19). Only 72% of all the men who died, and 69% of/...

of those who died before their 65th birthday were recorded as coalminers. These figures almost certainly underestimate the number of men who had ever been miners, although by what amount is impossible to say. They do however illustrate one of the difficulties inherent in interpreting Register General occupational mortality data and highlight the limited general usefulness of the latter if one is interested not simply in the immediately antecedent occupation of the deceased but on the effect of an industry on mortality. Irrespective of the validity of the present mortality data it must be apparent that the investigation of occupational or industrial mortality using current life table techniques gives a very incomplete picture. A more appropriate method would be to construct cohort life tables for recruits into the industry. Only one Nellie "recruit" had died and it was not possible, therefore, to do this procedure here.

In its response rate to the questionnaire this study was distinctly unusual. Complete co-operation was obtained from 61 (98%) of the 62 men selected and eligible for interview. One man had to be classified as a partial refusal when he declined to supply information about his income. Thus the middle response rate was 100%. This compares well with the 1975 GHS (OPCS, 1978 b) in which the middle response rate was 83.6%, with complete co-operation obtained from only 74.5% It is probable that the principal factors contributing to this favourable outcome included the thorough preparation which preceded the interviews, the close contact maintained throughout with the men through their former union delegate, and the fact that/...

that the interviewing was conducted by a single individual who was both highly motivated and medically qualified.

A noteworthy feature of the present study is the conspicuous absence of any control group. The deliberate decision not to include such a group will no doubt surprise many epidemiologists who have been nurtured in the belief that controls constitute essential elements of this type of research. I would contend, however, that proponents of this view are doubly wrong in that they fail to appreciate not only the sociological constraints of this philosophy but also its methodological inhibitions. In such epidemiological studies the level of mortality, ill-health, disease, health care or other characteristic is estimated in each of the two groups and the measured difference is attributed to the nature of their different experiences. Although this may appear superficially attractive and almost an extension of the principle of the controlled trial of drug therapy, it features weaknesses which are insufficiently understood and indeed so detract from it as to render the method of doubtful scientific value. If one examines the situation in coalmining it is clear that entry into or exclusion from the industry is not random. Coalworkers are highly selected. They enter the pits for many reasons; because they live in mining areas; because their fathers, uncles, brothers and friends were miners before them; because there may be no other jobs in the locality; because the salary is high; because they have been passed medically fit for this arduous work, and perhaps for other less obvious reasons. None of these can either be described as a/...

a random variable or controlled. Additionally, although it would not be an insurmountable task to find a comparison cohort, a group of men of the same age distribution from other industries, could we really identify which of the many other differences involved were relevant, let alone control them?

Superficially it may appear that this investigation has attempted to use information from reports of the Registrar General and from the GHS to construct a control group consisting of all British or Scottish men. This is not the case, as these crude comparisons with the population rates are presented merely to bring the figures into perspective. Coalworkers differ significantly from other workers not only in their health at age of entry but also throughout their lives in all aspects of their educational and socioeconomic experiences, all of which contribute to health. In a randomised controlled trial of drug therapy an attempt is made to vary only one or two relevant factors at a time. It does not appear possible, however, to identify true cohort control groups for coalminers when so many factors require to be matched, let alone identified. Clearly for those conditions or diseases in which the causal factor is well understood we can control one variable at a time. For example a comparison can be made of deaths from rock falls or pneumoconiosis between miners and men who do not work underground or are exposed to dust. However, if we wish to expand our horizons beyond this limited sphere, controls become much less useful.

Another point that is often forgotten is that controls also experience/...

experience ill-health due to their specific circumstances. Thus there is little point in comparing death rates due to accidents at work among miners and non-miners if the latter include building workers, farmers and fishermen. This example is obvious but in other conditions unknown factors may operate in both groups to reduce artificially the level of ill-health attributable to the occupation under investigation. A similar mechanism also applies to occupational studies which commence with groups of working men such as the Nellie cohort was in 1955, as all groups obtained in this way have already been influenced, especially in the older age ranges, by death, ill-health and migration. It should be realised that this is equally applicable to the control and study groups. Any investigation which commences with survivors fit enough to remain within either group automatically excludes those who have already left because of ill-health and can result in biased results and erroneous conclusions.

The final comment on the inappropriatness of cohort control groups in this kind of investigation relates to its greatest drawback. Comparisons between different groups in levels of health or in health service care generally fail to take us forward. Although it may be of academic interest to some that the ex-Nellie coalworkers were less healthy or more or less favourably served by the health services than others, it is of less interest to the most important group, namely the cohort itself. Their concern lies in the level of their health and what the health services are or are not doing for their problems and whether this is what they want and need. The real value, therefore, of comparative studies lies in the identification/...

identification of what is possible to achieve, i.e. what state of health and what standards of health care are obtainable under the best possible conditions of current practice. However this rarely features among those who plead for the inclusion of controls. On the contrary epidemiologists who make this plea frequently adhere to the philosophy of abstracted empiricism most critically exposed by Mills (1959).

Although the use of cohort controls is deemed to be of little use in such a study, it is possible to strive for the scientific objectivity that such a method seeks to confer on an investigation by following up not a cohort of working miners, but of new recruits into mining. By using their high level of health on entry into the industry as an internal control, the true incidence of ill-health resulting from coalmining can then be investigated. Such was the rationale behind the investigation of the health of those new recruits who entered the Nellie pit in the early 1950s. It was felt inappropriate to apply this method to an examination of what the health services were doing for the ex-Nellie recruits still resident in West Fife because of their extremely limited age-range. However, the inclusion of a 'control' group for this latter purpose would have suffered from the same drawbacks already discussed and was not included.

To summarise, this present study appears to have several epidemiological implications. In the first place, it has demonstrated that, if one knows where to find them, unorthodox sources of information are/...

are available which, in spite of difficulties, can be used to conduct meaningful epidemiological research. Secondly, it has shown that the principle of using cohort members themselves to generate missing data opens up interesting possibilities for increasing completeness of follow-up. Finally it is apparent that thorough preparation of the groundwork in investigations of this kind can achieve very high interview response rates, even when only limited resources are available.

7.3. The West Fife Nellie Community - Its Health and Health Services

By any standards the ex-Nellie coalworkers living in West Fife experienced a high level of ill-health. A high proportion had long-standing handicaps and limiting long-standing handicaps, and confinement to bed through illness was a common occurrence. Their smoking and drinking habits did not differ from other men of the same age although the effect of differential survival makes interpretation of the significance of this fraught with difficulties.

By and large the organisation of health services to the Nellie community left a lot to be desired. There was a general belief among health workers that they had insufficient resources to meet the needs of the population and deficiences appeared most acute in the hospital services of the NHS and in the social work services of Fife Regional Council. In the case of organisations concerned with environmental health there was the added difficulty for some of attempting to fulfil their legal obligations in the face of apparent antagonism from the courts of law. Reorganisation of the NHS in 1974/...

1974 may have united the three former divisions of the tripartite structure but little has been achieved outwith this limited sphere. Most organisations concerned with health care delivery had only nominal contact with one another although an exception was found at the primary care level in one part of the Nellie area where liaison between GPs, community and social work staff appeared to be much better. However, a serious lack of communication was found to exist between the NCB medical service and the NHS, a state of affairs which appeared to prejudice the effectiveness of the health care of these ex-Nellie coalworkers. There seems no valid reason for the apparent failure of NCB doctors to keep GPs fully informed about the medical condition of men discharged from the mines on grounds of ill-health. Although still in its infancy the recent establishment of VORAG* should aid both co-ordination of the activities of voluntary bodies in Fife and liaison between them and the other health services.

The West Fife ex-Nellie coalworkers were high users of primary care services although it must be taken into account that some of this may have arisen because interviewing was conducted in mid-winter. As many as 28% felt that the surgery was poorly situated for them or that the consulting hours were inconvenient. Clearly there are planning and other constraints which must be considered before deciding the site for any surgery or health centre. In general GPs locate their surgeries at sites which they themselves find convenient for various reasons. This should not apply, however, in the case of health centres owned by the Health Board. The high prevalence of/...

* Voluntary Organisations Regional Advisory Group.

of disability in mining communities must lead to a great deal of thought and discussion between local people and the Health Board before decisions about siting centres are taken. Consulting hours, on the other hand, are much more amenable to change, and more flexibility is required if they are to fit in with local work patterns. A high proportion of men whose last medical contact was with a GP had some complaint to make about the encounter. Basically these fell into two broad categories, difficulties or delays in securing a consultation, and problems associated with the consultation itself. Both require detailed examination by the GPs themselves and by the Health Board. Practice organisation and clinical practice no doubt contribute partly to the problem in some cases, but a major factor seems to be the large number of patients on each GP's list, an unsatisfactory situation exacerbated by the high levels of morbidity prevalent among these miners and ex-miners. This gains some support from the fact that as many as 16% of these ex-Nellie men would have consulted a doctor in the previous month if one had been readily available and accessible.

Very few data have been presented on the use of hospital services. Small numbers of men were involved and the use of these services is influenced not only by the level of ill-health experienced but also, and perhaps to a significant extent, by the referral policies of GPs and by the actual level of provision of services. The effect of referral policies would have required separate evaluation and data have been presented which suggest that there is a low level of provision of hospital services in Fife and a high level of unmet need.

Few/

Few ex-Nellie coalworkers were even acquainted with non-NHS organisations concerned with health care in West Fife, and among those who had been in touch with some such body during the previous year there was a high level of dissatisfaction. This was expressed most vocally against the environmental health services. Somewhat surprisingly in view of the morbidity reported, none of the men had been in contact with the Coal Industry Social Welfare Organisation, the Chest, Heart and Stroke Association, or the British Rheumatism and Arthritis Association. The first is concerned specifically with the welfare problems of miners and ex-miners and the other two voluntary bodies, although apparently well suited to dealing with some of the problems of mineworkers, do not appear to function anywhere in Fife.

It is obvious that the general social conditions of these West Fife men were much better than those endured by their fathers and grandfathers. The proportion with central heating and telephones did not differ from the national average although as much as half did not have these amenities. The significance of the latter is far-reaching for a group of men subject to chest and rheumatic troubles known to get worse in cold conditions. Furthermore, sufferers may also find it difficult to walk some distance to reach a public telephone when medical attention is required. In addition, the ex-Nellie coalworkers continue to remain relatively disadvantaged in their high level of overcrowding when judged by the "bedroom standard". It is also apparent, in view of the low average weekly income of £56, that there are still serious economic implications of a life in the mines.

7.4. The/

7.4. The Nellie Recruits

Although all recruits had at one time been coalface workers at the Nellie pit, only 27% were still working there 22 years later when the age range of this group was between 37 and 42. Of those interviewed 56% had left the industry completely, including 19% who were unemployed. It is therefore important to note that in a country in which the expected working life is some 40 years in the chosen occupation or profession, the median survival of these men in the coalmining industry was only 18½ years. This figure was even shorter than the average life on the face of 21.3 years found by Edmonds and Kerr (1960). Many had left because of ill-health and most of the others left because of intolerable conditions or worry about the effect of their work on their future health. Sub-optimal functional health was the lot of nearly half (46%) and nearly a third (32%) had limiting long-standing physical handicap resulting from mining. The prevalence of chronic disability was six times that of other Scottish men of the same age. It is clear that even if all the men who could not be interviewed because they had left Fife were in perfect health, the toll that mining exerted on the overall health of these recruits was indeed formidable. Although the levels did not reach conventional levels of statistical significance, men still employed in mining were more likely to be in optimal functional health than those who had left.

A curious finding was that less of these miners smoked or were regular drinkers than expected. The bias inherent in the process of selecting only recruits resident in Fife for interview or some local quirk of/...

of behaviour are possible explanations. Alternatively the personal habits of cohorts of miners may be in reality no more excessive than those of other men. In this case it may be that the standard OPCS practice of estimating the prevalence of smoking in working miners introduces a bias which distorts their results.

The case histories in the confirmatory study are largely self-explanatory. In three cases GPs had uncharitable comments to offer. In two (cases 208, 231) there appears to be enough evidence to doubt the validity of the GPs' remarks. In the first it conflicts with that of the NCB medical service and in the second, with this service and the opinion of the consultant orthopaedic surgeon. However, in the second of these two cases there is enough evidence to suggest that the initiating injury did not occur in the mines. Subsequent underground work, nevertheless, certainly exacerbated it. In the third case (218) there is a straight forward conflict of opinion between GP and patient.

There are several possible explanations for the divergent views in these three cases. It is possible that neither the men nor the GPs presented the facts as they knew them to be, or that they exaggerated them in order to influence my judgement. Both these possibilities seem unlikely. It is much more probable that the men gave genuine assessments of their health as they perceived it, and that the GPs also gave me genuine assessments as far as they knew them to be. In support of this, two GPs were completely ignorant of some major aspect of their patient's health, and none of the three GPs had/...

had received any correspondence whatsoever from the NCB medical service about the state of their patient's ill-health on leaving the mines.

Many of these recruits felt that the location of the surgery and consulting times were unsuitable and they were high users of this service. Twice as many as expected had consulted a GP in the preceding two weeks and the number of GP consultations per man per year was estimated to be two-and-a-half times as many. In addition, almost twice as many as expected had spent time in bed in the previous two weeks because of ill-health and the estimated average number of days in bed per year for each man was 23.9, again nearly double the expected value. It should be remembered, however, that some of these very high differences may have arisen because interviewing took place in mid-winter. Nevertheless they are of a similar order of magnitude as that found by Logan (1960) and Liddell (1973 a).

Many of those whose last medical consultation was with a GP complained about some aspect of the encounter. In all, 27% would have consulted a doctor in the previous month for advice or an examination had one been available. Complaints were also expressed about the environmental health services and none of the recruits had been in contact with a voluntary body. All these suggest that the men were either ignorant of or dissatisfied with a fairly wide range of health service activity.

Although the availability of central heating and telephones were very similar to the national average, 35% of recruits lived in overcrowded/...

overcrowded homes, a level seven times the national average. Furthermore these men in 1978 were earning on average only £2 more than the 1976 average Scottish wage. While miners remain working at the face, they may well earn high wages, but in this study of recruits over half had earnings in 1978 below the 1976 national average in Scotland.

This study of ex-Nellie recruits does not pretend to be the definitive investigation of the health implications of coalmining. A single cohort from one mine is far too selective for that possibility to be a reality. Moreover it was restricted to the 67% of recruits still resident in Fife. Such constraints clearly make generalisations speculative since there is obviously no way of estimating the health status of those who left. Although it is generally believed that migrants are healthier individuals than those who remain, this may not apply to coalworkers. It may equally be the case that men who left the mines because of ill-health had to move to other areas in search of suitable jobs. Whatever the situation, it is clear from Table 35 that even if all were in perfect health, the overall proportions with various degrees of ill-health or disability would remain much more than that of the general population. Furthermore no amount of perfect health among the migrants can detract from the finding that many recruits, only 22 to 25 years after first entering the mines, had already suffered serious ill-health as a direct consequence of their occupation. This investigation suggests that, when viewed broadly and from a functional point of view, the hypothesis that coalmining has a serious and detrimental effect on all aspects/...

aspects of health cannot be ruled out. It suggests that coalmining is still a far from healthy occupation, not necessarily because mortality is high, for the present methodology precluded such a conclusion, but because it an occupation which maims and disables a high proportion of men who enter it, discarding them after a relatively short working life, and condemning many to a subsequent life of unemployment and ill-health.

7.5. Where Do We Go From Here?

The present investigation does not end with the publication of this thesis. Indeed, in a sense, only the first stage is finished. Much more work needs to be done on the measurement of functional health and especially into its mental component. This is a task I hope to pursue in my future career as a community medicine specialist. It is also obvious that a much larger scale study is needed to produce a definitive account of the health of coalmining. This thesis has charted out one way in which this could be achieved, namely by following up cohorts of new recruits into the mining industry over the last 30 years. Research of this nature is well beyond the capabilities of one individual and would require the joint efforts of the NCB and medical research institutes. With a suitably trained team and the use of computers this could be no more difficult than the General Household Survey. The results would be intriguing. If conducted throughout the year the bias introduced into the present study by interviewing only during the winter months would be avoided. Furthermore it would open up the possibility not only of determining the health implications of mining but also of examining trends.

It is clear that large sections of our health service, including the primary care services, environmental health services, and the voluntary bodies, have failed in West Fife to reach these miners and ex-miners. Early in this thesis I proposed that problems of this nature can only be tackled when both sides engage together in dialogue. My next aim, therefore, is to make these findings available in a way that they can form the basis of discussion. Few professionals take kindly to the apparent criticisms of their work by outsiders. In such a situation most adopt defensive postures. It seems to me that action to remedy some of the problems highlighted is more likely to be taken if the discussion is initiated by the public itself. For this reason I now intend to go back to where I began this study, that is to the miners themselves, to present my findings, to discuss their implications, and in so doing to educate these men about what the health services can do to improve their health.

These are the tasks of the community medicine specialist as I see them. They are continuous, at each stage ferreting out the substantive problems and encouraging the dialogue necessary to solve them.

8. Conclusions.

An early aim of this research was to develop a working model of the concept of health for the needs of community medicine. It is proposed that this should be based on the WHO (1946) definition of health: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", and that the concept can be made operational by recognising the value judgements implicit in the notion and by establishing dialogue between health professionals and members of the community at large. The need to adopt a holistic approach and to include a functional element is emphasised. As a practical example the method has been applied to the investigation of the health and health care of a mining community in West Fife and the conceptual difficulties encountered are discussed.

A cohort of 427 men, the workforce at the Nellie coalmine, Lochgelly in 1955 has been followed up 22 years later. By using standard NHS sources 92% of the men were successfully traced and their vital status determined. Ex-Nellie mineworkers still living in Fife were approached for information about the remainder. In this way it was eventually possible to ascertain the vital status of all the men (100%) and to confirm this using NHS or Registrar General sources in 97%. It is suggested that this technique opens up interesting possibilities of increasing completeness of follow-up in similar types of investigation.

Using actuarial methods the mortality experience of the cohort was/...

was examined and found not to differ significantly from other men, nor from that of coalminers in Scotland or other parts of Britain. It appeared that the coalminers as a whole suffered from occupational diseases such as chest disease and the sequelae of mining accidents which, although disabling and maiming in their effect, had no overall statistically detectable effect on survival. Significantly more men died from pneumoconiosis. The mortality from ischaemic heart disease was significantly lower than that of all Scottish men in 1975, and from cerebrovascular disease significantly higher than men aged 15 to 64 in 1971 in England and Wales. However, for several reasons these mortality statistics should be viewed with caution: it is estimated that up to 4% of those classified alive may have died; there are major theoretical limitations inherent in the study of any cohort of working miners, not only because of their high levels of health on entry but also because of migration out of an differential survival within the industry, and there have been considerable changes in the pattern of mortality over the last 22 years. At least 25% of those who died before their 65th birthday and at least 28% overall had an occupation on their death certificate which was not coalmining, putting into question the value of routine occupational mortality data which fail to take account of overall industrial experience.

The organisation and relevance of the health services in West Fife were investigated by looking at them in action, speaking to health workers in all fields of practice, and interviewing ex-Nellie coalworkers. Both in general and particularly in the hospital and/...

and social work services, facilities were found to be inadequate to meet present demand. Co-operation between agencies was only nominal in some cases, and a serious lack of communication between the National Coal Board's medical service and GPs appeared to act to the detriment of ex-coalworkers.

A stratified simple random sample of 62 of the 228 ex-Nellie coalworkers still resident in West Fife was contacted. Interviews took place in the men's homes and the response rate was 100%. A high level of ill-health was found and the men were high users of primary care services. Although most found that these services were convenient for them, a substantial proportion found that the location of the surgery or consulting times were not. Men whose last medical encounter was with a GP had frequent complaints, including the lack of any explanation of their problem, dissatisfaction with the meeting, difficulties in obtaining appointments, and a feeling that GPs spent inadequate time on the consultation. The environmental health services fared no better. Men did not feel that the Environmental Health Department dealt adequately with their problems and Health and Safety at Work Inspectors came in for criticism for arranging inspections well in advance. These organisations appear to be in the position of needing to rely more heavily on the coercive forces of the law in order to satisfy the needs of the community they serve. Paradoxically, the courts of law seem foremost among those which thwart this work. Voluntary organisations too failed to reach these mineworkers and none of the men interviewed had had contact with any dealing with health/...

health in the previous year. Although the proportion with telephones and central heating was similar to the national average, overcrowding was much more common, and these must be viewed within the context of the high levels and type of disability experienced.

In an attempt to illustrate a methodology for the general investigation of the health implications of coalmining, contact was made with 37 men still resident in Fife out of the total of 56 teenage recruits at the Nellie pit in 1955. The response rate to interview was 100%. Although all these men had been face-workers at the Nellie, only 27% were still working at the face at the time of interview and a further 17% employed elsewhere in the industry; 19% were unemployed. The median time in the coal industry was only 18½ years and 19% had left on grounds of ill-health. Sub-optimal functional health was experienced by 46%. Long-standing handicaps and limiting long-standing handicaps, prevalent in 68% and 35% respectively, were both six times more common than in men throughout Scotland of the same age. A total of 32% had limiting long-standing handicaps attributed to mining and 14% were confirmed to have continuing severe disability as a direct result of mining. Severe respiratory symptoms were experienced by 11% and all had left the industry because of them. The prevalence of ill-health could not be explained by the personal habits of these recruits, among whom a smaller proportion were regular drinkers or current smokers than the general population. The proportion of men who had consulted a GP in the previous two weeks was over twice the national average and an estimate of the/...

the annual number of GP consultations was 2½ times higher. In the two weeks preceding the interview twice the national average number of men spent nearly twice as many days in bed because of ill-health. None of these differences could be entirely explained on the basis of selective migration of healthy men. The GP's surgery was in some way inconvenient to 35% and among those whose last medical encounter was with a GP 38% had some complaint. If doctors had been more readily accessible, 27% would have consulted one in the previous month and 32% would have made use of some aspect of the health services. The availability of home amenities such as central heating or a telephone was similar to the rest of Britain but 35% of the households were overcrowded, a figure seven times that for the rest of the country. Less than half these recruits were earning in 1978 as much as the 1976 national average gross weekly wage for Scotland.

It is suggested that more attention must be given to incorporating a mental component within the measurement of functional health and that a definitive study of the health of coalmining is possible if co-operation between the NCB and interested research institutes could be secured. Finally it is emphasised that some of the problems highlighted in this study can be tackled if dialogue can be established between the health services and the community. With this aim in mind it is proposed to return to the mining community among whom this study began. By educating them about its findings and by explaining to them what the health services can do, it is hoped that this will be the first step in initiating this discussion.

R E F E R E N C E S

ADAM, R.S.F. and EDMONDS, P.N. (1955). Leptospiral serology in Scottish coalminers. British Journal of Industrial Medicine, 12, 100.

ALDERSON, M.R. (1972). Some sources of error in British occupational mortality data. British Journal of Industrial Medicine, 29, 245.

ANDREWS, G.S. (1976). Coronary artery disease and coalworkers' pneumoconiosis. British Medical Journal, 2, 1133.

ARNOT, R.P. (1955). A history of the Scottish Miners. Allen & Unwin. London.

ASHFORD, J.R. (1960). The classification of chest radiographs for coalworkers' pneumoconiosis. British Journal of Industrial Medicine, 17, 293.

ASHLEY, D.J.B. (1968). Perinatal mortality in Wales. British Journal of Preventive and Social Medicine, 22, 132.

ASHLEY, D.J.B. (1969 a). Environmental factors in the aetiology of gastric cancer. British Journal of Preventive and Social Medicine, 23, 187.

ASHLEY, D.J.B. (1969 b). Environmental factors in the aetiology of lung cancer and bronchitis. British Journal of Preventive and Social Medicine, 23, 258.

ATKINS, J.B. (1957). Internal derangement of the knee joint in miners. British Journal of Industrial Medicine, 14, 121.

ATKINS, J.B. and MARKS, J. (1952). The role of staphylococcal infection in beat disorders of miners. British Journal of Industrial Medicine, 9, 296.

AUDY, J.R. (1973). Health as a quantifiable quantity. British Medical Journal, 4, 486.

BAILAR, J.C. and EDERER, F. (1964). Significance factors for the ratio of a Poisson variable to its expectation. Biometrics, 20, 339.

BENJAMIN, B. and HAYCOCKS, H.W. (1970). The analysis of mortality and other actuarial statistics. Cambridge University Press. London.

BERG, R.L. (1976). 1976 Health Status indexes conference - an annotated guide to the papers. Health Services Research, 11, 335.

BERGMAN, I. and CASSWELL, C. (1972). Lung dust and lung iron contents of coalworkers in different coalfields in Great Britain. British Journal of Industrial Medicine, 29, 160.

BLACK, J. (1953). Pneumoconiosis of coalminers in Scotland. British Journal of Industrial Medicine, 10, 101.

BRESLOW, L. (1972). A quantitative approach to the World Health Organisation definition of health: physical, mental and social well-being. International Journal of Epidemiology, 1, 347.

BROWN, P.W. and WESTWATER, A. (1954). History of the early Lochgelly coalfield. Story of Lochgelly village in 1854. John Westwater and Son, Lochgelly.

BUCK, C. (1975). Popper's philosophy for epidemiologists. International Journal of Epidemiology, 4, 159.

BUESS, H. (1962). The beginnings of industrial medicine in England. British Journal of Industrial Medicine, 19, 297.

BYRNE, M.L. and THOMPSON, L.F. (1972). Levels of wellness - a continuum for assessment. In Key concepts for the study and practice of nursing. Mosby, Saint Louis.

CAMERON, D. (1976). The community physician of the future. British Medical Journal, 1, 1210.

CAMPBELL, A.V. (1977). Establishing ethical priorities in medicine. British Medical Journal, 1, 818.

CAMPBELL, H., LYONS, J.P., GOUGH, J. and RYDER, R. (1973). Disability, survival and coalworkers' pneumoconiosis. British Medical Journal, 3, 351.

CARDUS, D. (1973). Towards a medicine based on the concept of health. Preventive Medicine, 2, 309.

CARDUS, D. and THRALL, R.M. (1977). Overview: Health and the planning of health care systems. Preventive Medicine, 6, 134.

CARTER, W.B., BOBBITT, R.A., BERGNER, M. and GILSON, B.S. (1976). Validation of an interval scaling; the sickness impact profile. Health Services Research, 11, 516.

CENTRAL STATISTICAL OFFICE (1977). The General Household Survey 1974. HMSO. London.

CHEN, M.K. (1976 a). Preface. Health Services Research, 11, 333.

CHEN, M.K. and BRYANT, B.E. (1975). The measurement of health - a critical and selective overview. International Journal of Epidemiology, 4, 257.

CHIANG, C.L. (1976). Making annual indexes of health. Health Services Research, 11, 442.

CHIANG, C.L. and COHEN, R.D. (1973). How to measure health: a stochastic model for an index of health. International Journal of Epidemiology, 2, 7.

COAL INDUSTRY SOCIAL WELFARE ORGANISATION (1977 a). Annual Report and Accounts 1976.

COAL INDUSTRY SOCIAL WELFARE ORGANISATION (1977 b). Scottish Welfare Committee Annual Report 1976.

COCHRANE, A.L. (1962). The attack rate of progressive massive fibrosis. British Journal of Industrial Medicine, 19, 52.

COCHRANE, A.L. (1972 a). The history of the measurement of ill health. International Journal of Epidemiology, 1, 89.

COCHRANE, A.L. (1972 b). Effectiveness and efficiency. The Nuffield Provincial Hospital Trust. London.

COCHRANE, A.L. (1973). Relation between radiographic categories of coalworkers' pneumoconiosis and expectation of life. British Medical Journal, 2, 532.

COCHRANE, A.L. (1976). An epidemiologist's view of the relationship between simple pneumoconiosis and morbidity and mortality. Proceedings of the Royal Society of Medicine, 69, 12.

COCHRANE, A.L. and CARPENTER, R.G. (1956). Factors influencing the radiological progression rate of progressive massive fibrosis. British Journal of Industrial Medicine, 13, 177.

COCHRANE, A.L., CARPENTER, R.G., MOORE, F. and THOMAS, J. (1964). The mortality of miners and ex-miners in the Rhondda Fach. British Journal of Industrial Medicine, 21, 38.

COCHRANE, A.L., DAVIES, I., CHAPMAN, P.J. and RAE, S. (1956). The prevalence of coalworkers' pneumoconiosis: its measurement and significance. British Journal of Industrial Medicine, 13, 231.

COCHRANE, A.L. and HIGGINS, I.T.T. (1961). Pulmonary ventilatory functions of coalminers in various areas in relation to the X-ray category of pneumoconiosis. British Journal of Preventive and Social Medicine, 5, 1.

COCHRANE, A.L. and MOORE, F. (1978). Preliminary results of a twenty-year follow-up of a random sample of an industrial town. British Medical Journal, 1, 411.

COCHRANE, A.L. and THOMAS, J. (1965). Changes in the prevalence of coalworkers' pneumoconiosis among miners and ex-miners in the Rhondda Fach 1951 - 61. British Journal of Industrial Medicine, 22, 49.

CROFTON, E.C. (1969). A study of lung cancer and bronchitis mortality in relation to coal-mining in Scotland. British Journal of Preventive and Social Medicine, 23, 141.

CULYER, A.J. (1976). Need and the National Health Service. Martin Robertson; London.

CUNNINGHAM, A.S. (c 1908). History of the Colliery from earliest times to the present day. The Lochgelly Iron and Coal Company. Lochgelly.

CURRY, B. (1973). Survival in coalworkers' pneumoconiosis. British Medical Journal, 3, 633.

DAVIES, C.N. (1949). Inhalation risk and particle size in dust and mist. British Journal of Industrial Medicine, 6, 245.

DAVIES, C.N. (1952). Dust sampling and lung disease. British Journal of Industrial Medicine, 9, 120.

DAVIES, D. (1973). Disability, survival and coalworkers' pneumoconiosis. British Medical Journal, 2, 773.

DAVIES, D. (1974). Disability and coalworkers' pneumoconiosis. British Medical Journal, 2, 652.

DAVIES, D. (1976). Deaths from coronary artery disease and coalworkers' pneumoconiosis. British Medical Journal, 2, 925.

de KADT, E. (1976). Wrong priorities in health. New Society, 36, 525.

DICK, J.A. (1972). Hearing standards in miners. Lancet, 2, 1087.

DIGHT, S.E. (1976). Scottish Drinking Habits. O.P.C.S., London.

DOLFMAN, M.L. The concept of health: an historic and analytic examination. The Journal of School Health, 43, 491.

DOLFMAN, M.L. (1974). Towards operational definitions of health. The Journal of School Health, 44, 206.

DRAPER, P., BEST, G., DENNIS, J. (1976). Health, money and the National Health Service. Unit for the Study of Health Policy, London.

DUBOS, R. (1960). Mirage of health. Allen and Unwin, London.

DUCKHAM, B.F. (1970). A history of the Scottish Coal Industry. Volume I: 1700 - 1815. David and Charles. Newton Abbot.

DUGGAN, M.J., SOILLEUX, P.J., STRONG, J.C. and HOWELL, D.M. (1970). The exposure of United Kingdom miners to radon. British Journal of Industrial Medicine, 27, 106.

DUNN, H.L. (1959). High-level wellness for man and society. American Journal of Public Health, 49, 786.

DUNNELL, K. and CARTWRIGHT, A. (1972). Medicine takers, prescribers and hoarders. Routledge and Paul, London.

EDMONDS, O.P. (1958). Industrial dermatitis in the coal-miner. British Journal of Industrial Medicine, 15, 188.

EDMONDS, O.P., FERNANDEZ, R.H.P. and BATES, L.B. (1954). A study of boils at three collieries. British Journal of Industrial Medicine, 11, 123.

EDMONDS, O.P. and KERR, D.S. (1960). Observations on the occupational life history of the coal-face worker at two collieries. British Journal of Industrial Medicine, 17, 234.

ENGEL, G.L. (1960). A unified concept of health and disease. Perspectives in Biology and Medicine, 3, 459.

ENGEL, G.L. (1977). The need for a new medical model: a challenge for biomedicine. Science, 196, 129.

FANSHEL, S. (1972). A meaningful measure of health for epidemiology. International Journal of Epidemiology, 1, 319.

FANSHEL, S. and BUSH, J.W. (1970). A health-status index and its application to health-services outcomes. Operations Research, 18, 1021.

FARER, L.S. (1976). Screening for tuberculosis in patients with pneumoconiosis. Lancet, 1, 359.

FAY, J.W.J. and ASHFORD, J.R. (1960). The study of observer variation in the radiological classification of pneumoconiosis. British Journal of Industrial Medicine, 17, 279.

FAY, J.W.J. and ASHFORD, J.R. (1961). A survey of the methods developed in the National Coal Board's pneumoconiosis field research for correlating environmental exposure with medical condition. British Journal of Industrial Medicine, 18, 175.

FIFE REGIONAL COUNCIL (1976 a). Regional Report 1976. Glenrothes.

FIFE REGIONAL COUNCIL (1976 b). Regional Report 1976: Technical working paper - 2. Employment. Glenrothes.

FISHER, S.W. (1944). Health hazards of coal-mining. British Journal of Industrial Medicine, 1, 153.

FLETCHER, C.M. (1972). Coalminers' pneumoconiosis. British Medical Journal, 2, 353.

FLETCHER, C.M. and OLDHAM, P.D. (1951). The use of standard films in the radiological diagnosis of coalworkers' pneumoconiosis. British Journal of Industrial Medicine, 8, 138.

FOX, A.J. and COLLIER, P.F. (1976). Low mortality rates in industrial cohort studies due to selection for work and survival in the industry. British Journal of Preventive and Social Medicine, 30, 225.

GAULDIE, E. (1976). The Middle Class and Working-class Housing in the Nineteenth Century. In Social Class in Scotland. Past and Present. John Donald Ltd., Edinburgh.

GELFAND, H.M. (1976). On measuring health or illness. American Journal of Public Health, 66, 95.

GENTLES, J.C. and HOLMES, J.G. (1957). Foot ringworm in coal-miners. British Journal of Industrial Medicine, 14, 22.

GOLDMAN, K.P. (1965). Mortality of coal-miners from carcinoma of the lung. British Journal of Industrial Medicine, 22, 72.

GOLDSMITH, S.B. (1972). The status of health status indicators. Health Services Reports, 87, 212.

GORDON, N.S. (1975). Screening for tuberculosis in patients with pneumoconiosis. Lancet, 2, 976.

GROGONO, A.W. and WOODGATE, D.J. (1971). Index for measuring health. Lancet, 2, 1024.

HART, J.T. (1971). The health of coal mining communities. Journal of the Royal College of General Practitioners, 21, 517.

HEADY, J.A. (1959). Filial mortality. British Journal of Industrial Medicine, 16, 70.

HEALTH AND SAFETY COMMISSION (1977). Report 1974 - 76. HMSO. London.

HEALTH AND SAFETY EXECUTIVE (1976). Health and safety: mines and quarries, 1975. HMSO. London.

HEALTH AND SAFETY EXECUTIVE (1977). Health and safety: mines and quarries, 1976. HMSO. London.

HEASMAN, M.A., LIDDELL, F.D.K. and REID, D.D. (1958). The accuracy of occupational vital statistics. British Journal of Industrial Medicine, 15, 141.

HERON, A. and BRAITHWAITE, D. (1953). Emotional stability in colliery workers. British Journal of Industrial Medicine, 10, 27.

HIGGINS, I.T.T. (1972). Coalminers' pneumoconiosis. British Medical Journal, 2, 713.

HIGGINS, I.T.T. and COCHRANE, A.L. (1961). Chronic respiratory disease in a random sample of men and women in the Rhondda Fach in 1958. British Journal of Industrial Medicine, 18, 93.

HOLMAN, R. (1909). Character studies of the miners of West Fife. West Fife Echo. Dunfermline.

HOLMAN, T. (1947). Historical relationship of mining silicosis, and rock removal. British Journal of Industrial Medicine, 4, 1.

JACOBSEN, M. (1977). Dust exposure, lung diseases, and coalminers' mortality. Ph.D. Thesis, University of Edinburgh.

JACOBSEN, M., RAE, S., WALTON, W.H. and ROGAN, J.M. (1970). New dust standards for British coalmines. Nature, 227, 445.

JACOBSEN, M., RAE, S., WALTON, W.H. and ROGAN, J.M. (1971). The relationship between pneumoconiosis and dust-exposure in British coalmines. In Inhaled Particles III. Unwin. Surrey.

JAGOE, J.R. and PATON, K.A. (1975). Reading chest radiographs for pneumoconiosis by computer. British Journal of Industrial Medicine, 32, 267.

JAMES, W.R.L. (1955). Primary lung cancer in South Wales coal-workers with pneumoconiosis. British Journal of Industrial Medicine, 12, 87.

JAMES, W.R.L. and THOMAS, A.J. (1956). Cardiac hypertrophy in coalworkers' pneumoconiosis. British Journal of Industrial Medicine, 13, 24.

JOHNSTON, T. (1946). The history of the working classes in Scotland. EP Publishing Ltd., Wakefield. England.

JUS, A. (1973). Social systems and the criteria of health as defined by the World Health Organisation. American Journal of Psychiatry, 130, 125.

KAGAN, A.R. and LEVI, L. (1974). Health and environment - psychosocial stimuli: a review. Social Science and Medicine, 8, 225.

KAPLAN, R.M., BUSH, J.W. and BERRY, C.C. (1976). Health status: types of validity and the index of well-being. Health Services Research, 11, 478.

KELLGREN, J.H. and LAWRENCE, J.S. (1952). Rheumatism in miners Part II: X-ray study. British Journal of Industrial Medicine, 9, 197.

KELMAN, S. (1975). The social nature of the definition problem in health. International Journal of Health Services, 5, 625.

KOHN, R. and WHITE, K. (1976). Health care: an international study. Oxford University Press, London.

LAMB, D. (1976). A survey of emphysema in coalworkers and the general population. Proceedings of the Royal Society of Medicine, 69, 14.

LAMM, G. (1972). Problems in the definition of ill health. International Journal of Epidemiology, 1, 357.

LANCET (1972), 2, 1087. Hearing standards in miners (Editorial).

LANCET (1974), 1, 81. The miners: a special case. (Editorial).

LAPP, N.L., MORGAN, W.K.C., ORTMEYER, C.E. and REGER, R. (1974). Miners' health. Lancet, 1, 351.

LAWRENCE, A. and WYNDHAM, C.H. (1972). Accidents. In Medicine in the Mining Industries. Heinemann. London.

LAWRENCE, J.S. and AITKEN-SWAN, J. (1952). Rheumatism in Miners Part I: Rheumatic complaints. British Journal of Industrial Medicine, 9, 1.

LAWRENCE, J.S. (1955). Rheumatism in coalminers Part III: occupational factors. British Journal of Industrial Medicine, 12, 249.

LEATHART, G.L. (1959). The mechanical properties of the lung in pneumoconiosis of coalminers. British Journal of Industrial Medicine, 16, 153.

LEININGER, M.M. (1969). Introduction: Nature of science in nursing. Nursing Research, 18, 388.

LERNER, M. (1973). Conceptualization of health and social well-being. Health Services Research, 8, 6.

LEWIS, A. (1953). Health as a social concept. British Journal of Sociology, 4, 109.

LIDDELL, F.D.K. (1960). The measurement of occupational mortality. British Journal of Industrial Medicine, 17, 228.

LIDDELL, F.D.K. (1961). The effect of film quality on reading radiographs of simple pneumoconiosis in a trial of X-ray sets. British Journal of Industrial Medicine, 18, 165.

LIDDELL, F.D.K. (1963). An experiment in film reading. British Journal of Industrial Medicine, 20, 300.

LIDDELL, F.D.K. (1973 a). Morbidity of British coalminers in 1961 - 62. British Journal of Industrial Medicine, 30, 1.

LIDDELL, F.D.K. (1973 b). Mortality of British coalminers in 1961. British Journal of Industrial Medicine, 30, 15.

LIDDELL, F.D.K. (1977). Radiological assessment of small pneumoconiotic opacities. British Journal of Industrial Medicine, 34, 85.

LIDDELL, F.D.K. and MAY, J. (1958). A statistical study of coal-mining accidents. British Journal of Industrial Medicine, 15, 262.

LION, J.S. (1958). The emotional stability of miners with nystagmus. British Journal of Industrial Medicine, 15, 204.

LION, J.S. (1960). A comparison of the emotional stability of coalminers and railwaymen. British Journal of Industrial Medicine, 17, 41.

LOCK, S. (1976). Priorities: some personal views. British Medical Journal, 2, 1548.

LOGAN, W.P.D. (1960). Morbidity statistics from general practice. Volume II (Occupation). HMSO. London.

LOWE, C.R. and KHOSLA, T. (1972). Chronic bronchitis in ex-coalminers working in the steel industry. British Journal of Industrial Medicine, 29, 45.

LYONS, J.P., RYDER, R., CAMPBELL, H. and GOUGH, J. (1972 a). Pulmonary disability in coalworkers' pneumoconiosis. British Medical Journal, 1, 713.

LYONS, J.P., CAMPBELL, H., GOUGH, J. and RYDER, R.C. (1972 b). Coalminers' pneumoconiosis. British Medical Journal, 3, 703.

MAHLER, H. (1977). Tomorrow's medicine and tomorrow's doctors. WHO Chronicle, 31, 60.

MATTHEWS, B.F. (1959). Dermatitis in the South Wales mining industry: a report of a survey of two collieries. British Journal of Industrial Medicine, 16, 200.

MEDICAL RESEARCH COUNCIL (1965). Definition and classification of chronic bronchitis. Lancet, 1, 775.

MEDICAL RESEARCH COUNCIL (1966). Chronic bronchitis and occupation. British Medical Journal, 1, 101.

MEIKLEJOHN, A. (1951). History of lung diseases of coalminers in Great Britain: Part I, 1800 - 1875. British Journal of Industrial Medicine, 8, 127.

MEIKLEJOHN, A. (1952 a). History of lung diseases of coalminers in Great Britain: Part II, 1875 - 1920. British Journal of Industrial Medicine, 9, 93.

MEIKLEJOHN, A. (1952 b). History of lung diseases of coalminers in Great Britain: Part III, 1920 - 1952. British Journal of Industrial Medicine, 9, 208.

MEIKLEJOHN, A. (1960). The origin of the term 'pneumokoniosis'. British Journal of Industrial Medicine, 17, 155.

MILLS, C.W. (1959). The sociological imagination. Pelican. Harmondsworth, Middlesex.

MINISTRY OF LABOUR AND NATIONAL SERVICE (1959). The length of working life of males in Great Britain. HMSO. London.

MOFFAT, A. (1965). My life with the miners. Lawrence and Wishart. London.

MOONEY, F. (1975). Coalworkers' pneumoconiosis and carcinoma of the lung. Lancet, 1, 43.

MORGAN, W.K.C. (1974). Disability and coalworkers' pneumoconiosis. British Medical Journal, 3, 343.

MORGAN, W.K.C. and LAPP, N.L. (1976). Respiratory disease in coalminers. American Review of Respiratory Disease, 113, 531.

MUIR, A. (1953). The Fife Coal Company Limited: A Short History. The Fife Coal Co. Ltd. Leven.

MUIR, D.C.F., BURNS, J., JACOBSEN, M. and WALTON, W.H. (1977). Pneumoconiosis and chronic bronchitis. British Medical Journal, 2, 424.

McCALLUM, R.I. (1952). Pneumoconiosis of coalminers in north east England with special reference to the Durham coalfield. British Journal of Industrial Medicine, 9, 99.

McCALLUM, R.I. and BROWNE, R.C. (1955). Coalminers pneumoconiosis in four collieries in County Durham. British Journal of Industrial Medicine, 12, 279.

McCALLUM, R.I. and NEWELL, D.J. (1958). Pneumoconiosis of coalworkers in three Northumbrian collieries. British Journal of Industrial Medicine, 15, 178.

McKEOWN, T. (1976). The role of medicine. The Nuffield Provincial Hospitals Trust, London.

McLINTOCK, J.S. (1971). The selection of juvenile entrants to mining. British Journal of Industrial Medicine, 28, 45.

McLINTOCK, J.S. (1975). Coalworkers' pneumoconiosis and carcinoma of the lung. Lancet, 1, 224.

NATIONAL COAL BOARD (NCB) (1958). A short history of the Scottish coal-mining industry. National Coal Board, Scottish Division. Edinburgh.

NATIONAL COAL BOARD (NCB)(1975). Coal in Scotland. NCB. London.

NATIONAL COAL BOARD (NCB)(1976). National Coal Board Medical Service Annual Report 1975 - 76. NCB. London.

OFFICE OF POPULATION CENSUSES AND SURVEYS (OPCS) (1970). Classification of occupations 1970. HMSO. London.

OFFICE OF POPULATION CENSUSES AND SURVEYS (OPCS) (1978 a). Occupational mortality: The Registrar General's decennial supplement for England and Wales, 1970 - 72. HMSO. London.

OFFICE OF POPULATION CENSUSES AND SURVEYS (1978 b). The general household survey 1975. HMSO. London.

OLDHAM, P.D. and BERRY, G. (1972). Coalminers' pneumoconiosis. British Medical Journal, 2, 292.

OLDHAM, P.D. and ROACH, S.A. (1952). A sampling procedure for measuring industrial dust exposure. British Journal of Industrial Medicine, 9, 112.

PARKES, W.R., PHILLIPS, T. and WILLIAMSON, R.G.B. (1976). Coronary artery disease and coalworkers' pneumoconiosis. British Medical Journal, 2, 1319.

PATRICK, D.L., BUSH, J.W., CHEN, M.M. (1973 a). Toward an operational definition of health. Journal of Health and Social Behaviour, 14, March, 6.

PATRICK, D.L., BUSH, J.W. and CHEN, M.M. (1973 b). Methods for measuring levels of well-being for a health status index. Health Services Research, 8, 228.

PEARSON, N.G., ASHFORD, J.R., MORGAN, D.C., PASQUAL, R.S.H. and RAE, S. (1965). Effect of quality of chest radiographs on the categorisation of coalworkers' pneumoconiosis. British Journal of Industrial Medicine, 22, 81.

PHILLIPS, T.J.G. (1970). Influence of surgery for peptic ulcer on pneumoconiosis and tuberculosis. British Journal of Industrial Medicine, 27, 245.

PUROLA, T. (1972). A systems approach to health and health policy. Medical Care, 10, 373.

RAE, S., ASHFORD, J.R., MORGAN, D.C., PASQUAL, R.S.H. and PEARSON, N.G. (1963). A comparison of some alternative procedures in the classification of chest radiographs for coalworkers' pneumoconiosis. British Journal of Industrial Medicine, 20, 293.

REGISTRAR GENERAL (1957). Annual Report of Registrar General for Scotland. 1956 No. 102. HMSO. Edinburgh.

REGISTRAR GENERAL (1967). Annual Report of Registrar General for Scotland. 1966 No. 112. HMSO. Edinburgh.

REGISTRAR GENERAL (1969 a). LIFE TABLES 1960 - 62. First supplement to the 114th Annual Report of the Registrar General for Scotland 1968. HMSO. Edinburgh.

REGISTRAR GENERAL (1969 b). Occupational mortality 1959 - 63. Second supplement to the 114th Annual Report of the Registrar General Scotland 1968. HMSO. Edinburgh.

REGISTRAR GENERAL (1971). Decennial supplement, England and Wales 1961. Occupational Mortality Tables. HMSO. London.

REGISTRAR GENERAL (1976). Annual Report of Registrar General for Scotland. 1975 No. 121. HMSO. Edinburgh.

REID, D.D. (1959). Mortality in mining and quarrying occupations. British Journal of Industrial Medicine, 16, 73.

RIVERS, D., JAMES, W.R.L., DAVIES, D.G. and THOMSON, S. (1957). The prevalence of tuberculosis at necropsy in progressive massive fibrosis of coalworkers. British Journal of Industrial Medicine, 14, 39.

RIVERS, D. and WISE, M.E. (1960). Dust content, radiology, and pathology in simple pneumoconiosis of coalworkers. Part II: Detailed analysis of the data. British Journal of Industrial Medicine, 17, 93.

RIVERS, D., WISE, M.E., KING, E.J., and NAGELSCHMIDT, G. (1960). Dust content, radiology, and pathology in simple pneumoconiosis of coalworkers. Part I: General observations. British Journal of Industrial Medicine, 17, 87.

ROANTREE, W.B. (1957). A review of 102 cases of beat conditions of the knee. British Journal of Industrial Medicine, 14, 253.

ROGAN, J.M. (1972). Medicine in the mining industries. Heinemann. London.

ROGAN, J.M., ATTFIELD, M.D., JACOBSEN, M., RAE, S., WALKER, D.D. and WALTON, W.H. (1973). Role of dust in the working environment in development of chronic bronchitis in British coalminers. British Journal of Industrial Medicine, 30, 217.

ROGAN, J.M., RAE, S. and WALTON, W.H. (1966). The National Coal Board's pneumoconiosis field research - an interim review. In Inhaled Particles and Vapours II. Pergamon Press, Oxford.

ROOK, A. and HODGSON, G. (1956). Dermatitis in coalminers. British Journal of Industrial Medicine, 13, 281.

ROOKE, G.B., DEMPSEY, A.N. and WARD, F.G. (1976). Coronary artery disease and coalworkers' pneumoconiosis. British Medical Journal, 2, 925.

ROSSITER, C.E. (1972). Relation between content and composition of coalworkers' lungs and radiological appearances. British Journal of Industrial Medicine, 29, 31.

RYDER, R., LYONS, J.P., CAMPBELL, H. and GOUGH, J. (1970). Emphysema in coalworkers' pneumoconiosis. British Medical Journal, 3, 481.

SAYED, Q.A. (1975). Screening for tuberculosis in patients with pneumoconiosis. Lancet, 2, 1212.

SCOTTISH HOME AND HEALTH DEPARTMENT (1971). Doctors in an integrated health service. HMSO. Edinburgh.

SCOTTISH HOME AND HEALTH DEPARTMENT (1977). Scottish Health Authorities Revenue Equalisation. HMSO. Edinburgh.

SCOTTISH OFFICE (1978). Scottish abstract of statistics 7/1977. HMSO. Edinburgh.

SHARRARD, W.J.W. (1963). Aetiology and pathology of beat knee. British Journal of Industrial Medicine, 20, 24.

SHARRARD, W.J.W. and LIDDELL, F.D.K. (1962). Injuries to the semilunar cartilages of the knee in miners. British Journal of Industrial Medicine, 19, 195.

SHELDON, A. (1974). Toward a general theory of disease and medical care. Science, Medicine and Man, 1, 237.

SMITH, A. (1977). Are we any healthier? New Society, 41, 485.

SMITH, R.A. (1959). Lung cancer in coalminers. British Journal of Industrial Medicine, 16, 318.

SOM, R.K. (1973). A manual of sampling techniques. Heinemann. London.

STONE, D.H. (1976). Is there a future for community medicine? British Medical Journal, 2, 1086.

STOUMAN, K. and FALK, I.S. (1939). Skeleton standard report on the state of health of the population and factors influencing it. Bulletin of the Health League of Nations, 8, 63.

SUSSER, M. (1974). Ethical components in the definition of health. International Journal of Health Service, 4, 539.

TEMPEST, M.N. and ATKINS, J.B. (1958). The influence of clothing on the pattern and severity of burns studied in some recent colliery fire-damp ignitions. British Journal of Industrial Medicine, 15, 147.

TERRIS, M. (1975). Approaches to an epidemiology of health. The American Journal of Public Health, 65, 1037.

WATKINS, J.T., HUNT, T.A., FERNANDEZ, R.H.P. and EDMONDS, O.P. (1958). A clinical study of beat knee. British Journal of Industrial Medicine, 15, 105.

WHITFIELD, J.W. (1954). Individual differences in accident susceptibility among coalminers. British Journal of Industrial Medicine, 11, 126.

WILKES, R. (1956). A social and occupational study of injured hands. British Journal of Industrial Medicine, 13, 119.

WISE, M.E. and OLDHAM, P.D. (1963 a). Estimating progression of coalworkers' simple pneumoconiosis from readings of radiological categories. British Journal of Industrial Medicine, 20, 124.

WISE, M.E. and OLDHAM, P.D. (1963 b). Effect of radiographic technique on readings of categories of simple pneumoconiosis. British Journal of Industrial Medicine, 20, 145.

WORLD HEALTH ORGANIZATION (1946). Official Records World Health Organization, 2, 100.

WORLD HEALTH ORGANIZATION (1957). Measurement of levels of health. WHO, Geneva.

WORLD HEALTH ORGANIZATION (1960). Local health service. World Health Organization, Geneva.

WORLD HEALTH ORGANIZATION (1967). Manual of the international statistical classification of diseases, injuries and cause of death. World Health Organization, Geneva.

WYLIE, C.M. (1970). The definition and measurement of health and disease. Public Health Reports, 85, 100.

YULE, G.U. (1934). On some points relating to vital statistics, more especially statistics of occupational mortality. Journal of the Royal Statistical Society, 97, 1.

Appendix 1: Questionnaire.

Name:

Address:

Date of birth:

Letter posted on:

Called for interview:

	Time	Date	Successful/Unsuccessful
1.			
2.			
3.			
4.			

No interview obtained because:

1. Refusal.
2. No one at home after repeated calls.
3. No longer resident there, new address unknown.
4. Other (specify).

Dr. Ian G. Jones

January 1978.

Employment history

1. When did you first (go into the pits) (enter the coalmining industry)? Year -

2. When did you first start working at the Nellie? Year -

3. When did you finally stop working at the Nellie? Year -

4. Did you work at any other pits between these two years?
If yes, during which years?

5. At the moment do you have a full- or part-time job?
If yes, main job last week:
Occupation:
Industry:

6. At the moment, are you:
   a) on holiday or off sick from work?
   b) retired from work compulsorily because of your age?
   c) retired from work voluntarily because of your age?
   d) retired from work because of your health (specify)?

   e) unemployed for other reasons (specify)?

7. When did you finally stop working in the pits?
Still working/Year stopped -

8. Why did you leave the pits:
   a) because of your age?
   b) because of ill-health (specify)

   c) /

c) Although you weren't ill, you just didn't feel up to it any more (specify)?

d) other (specify)?

9. Between 19__, the year you went into the pits, and now, what other jobs have you done?

	Date started and stopped	Occupation	Industry
1.			
2.			
3.			
4.			
5.			
6.			

10. Since stopping work at the Nellie, have you had any time when you were out of work or unemployed because:

a) you were made redundant?

b) you had to stop work because of your health?

c) of other reasons?

If yes, specify dates and reason.

Functional health

A. Social

11. If you are over retirement age, do you manage to do housework or keep house for yourself and other members of your family?

12. Do you need special working aids or rest periods to do housework or your job?

13. If you manage a job, or housework if you are retired, do you do any of the following: shopping, playing games, hobbies, taking part in clubs, societies or churches?

14. If you cannot manage a job, or keep house if you are retired, even with special aids or rest periods, do you need any help to dress, bath or feed yourself?

B. Mobility

15. Can you (go on the bus) (drive a car) alone and without any difficulty?

16. If not, do you still manage to do this, or to get around the community, but with some difficulty, or if given help?

17. If you cannot even manage this, are you at home for all or most of the day because of your health, or do you only get out if someone is there to help you?

If not, a) lives in hospital or nursing home.

b) in special care unit.

C./

C. Physical

18. Can you walk freely with no limitations of any kind?

19. If not, can you walk with the help of a stick, crutches or other aid?

20. When you walk, is your speed or distance reduced by your general health, or is your walking limited in lifting, stooping, using stairs, or going up hill?

21. If you cannot walk, even with an aid, can you get around alone in a wheelchair?

22. If not, are you in bed or in a chair for most of the day?

Symptomatic health

Now I'd like to ask you about your past health.

23. Can I check whether you've ever had any problems with bronchitis, hay fever, asthma, any allergy, varicose veins, heart trouble, infectious diseases, trouble with the bowels, kidneys or bladder, rheumatism, arthritis, any of the diseases miners get such as pneumoconiosis, silicosis, the beats, nystagmus, Weil's disease, accidents or anything else?

24. Do you have any long-standing (handicap) (impairment) (ill-health) (health problem)? Do you think you got this through working in the mines?

Health problem ? resulted from mines

Now I'd like to ask you about your present health and how you feel nowadays.

25. Do you get any chest pain at rest or on exercise?

26. a) Do you cough on getting up first thing in the morning?
    b) Do you cough like this on most days for as much as 3 months in the year?
    c) Do you cough during the rest of the day (not just at the end of a shift)?
    d) Do you cough during the rest of the day for as much as 3 months in the year?

27. a) Do you bring up phlegm on getting up first thing in the morning?
    b) Do you bring up phlegm like this on most days for as much as 3 months in the year?
    c) Do you bring up phlegm during the rest of the day (not just at the end of a shift)?
    d) Do you bring up phlegm like this on most days for as much as 3 months in the year?

28. Do you have to walk slower than other people on level ground because of shortness of breath?

29. Do you have any trouble (specify) with:-

a) your eyesight?

b) your hearing?

c) your speech?

d) learning, remembering or thinking clearly?

e) headaches, dizziness, fits or faints?

f) sleeplessness?

g) spells when you feel upset, worried, anxious, depressed, down in the dumps, or cry?

h) undue tiredness?

i) your mouth, gums, teeth, nose or throat?

j) being over- or under-weight?

k) your stomach or bowels, including hernias, ruptures, indigestion, pain, loss of appetite, vomiting, diarrhoea, constipation, passing blood or piles?

l) passing water (emptying the bladder) (having a pee), including pain, burning, discharge, blood, difficulty starting, or going too often or having to go in a hurry to the toilet?

m) palpitations or thumping heart?

n)/

n) swollen ankles?

o) your back?

p) aches or pains in the joints, muscles, legs or arms?

q) rashes, itches, sores, ulcers or other skin troubles?

r) burns, bruises or other accidents?

s) corns, bunions or any other trouble with your feet?

t) anything else I haven't mentioned already?

30. Are you taking any medicine or has your doctor put you on a diet for your health?

31. a) Do you smoke (specify)?

b) Have you ever smoked as much as one cigarette a day for as long as 1 year?

c) Do you drink alcohol (specify)?

Primary care services

32. Who is your G.P.?

33. Where are the consulting rooms?

34./

34. When were you last at these consulting rooms?

35. Does it take you long to get there? How long?

36. From your point of view, are they in a handy place or not (specify)?

37. Are the hours when you can be seen handy for you or not (specify)?

General health services

38. Within the last 4 weeks have you consulted, seen, visited or spoken with any doctor about your health either in hospital, a surgery or anywhere else?

Dates Names of doctors Places of consultation Reason

39. If not, when was the most recent time you consulted, saw, visited or spoke with any doctor about your health?

Date:

Name of doctor:

Place of consultation:

Reason:

40. For your most recent consultation, visit, or talk with a doctor about your health, did you have an appointment?

41./

41. From the time you decided or it was decided that you should get in touch with the doctor, how long was it until you saw him/her?

42. Was this longer than you wanted to wait?

43. When you saw the doctor, did you have to wait too long or not too long in the waiting room?

44. Do you feel that, on that occasion, the doctor spent enough time with you or not enough time?

45. Did the doctor explain to you what your problem was about in a way you could understand? What did he/she say could be done to help you overcome this problem?

46. Were you satisfied or dissatisfied with what happened at that consultation, visit or talk (specify)?

47. Within the last 4 weeks did you talk with, consult or visit any of the following people about your health? (Specify number of times, when, and in what circumstances)

a) nurse at the surgery

b) nurse at the hospital

c) nurse at work

d) other nurse

e) optician

f) chiropodist

g) dentist

h) chemist (pharmacist)

i)/

i) social worker

j) other health worker

48. Within the last 4 weeks did you make use of any of the following services? (Specify number of times, when and in what circumstances):

a) ambulance

b) home help

c) meals on wheels

d) centre for the elderly

49. Within the last 4 weeks would you like to have made use of any of these services or spoken to a doctor or any other health worker, if they had been available (specify)?

50. Within the last 2 weeks did you stay in bed for the whole day or for part of the day because you were not feeling well? How many days were you in bed, why, did you consult your G.P. about your problem and if not, why not?

Hospital services

51. Within the last 12 months have you been in hospital, or in a home either as a day patient or for one or more/...

more nights?

Dates of Admission	Discharge	Name of Hospital or Home	Main Reason

52. If not, when and for what reason, and where was your most recent admission to hospital?

53. For your most recent admission to hospital, how long did you have to wait to be admitted after it was decided that you should go in?

Other health services

54. Within the last 12 months have you been in touch with the local health council on any health matter (specify)?

55. In the last 12 months have you had any contact with anyone connected with the public or other health services? (Specify)

Prompt:-

a) Environmental health officer

b)/

b) Health and safety inspector

c) Animal welfare inspector

d) River purification board inspector

e) Other

56. If yes, do you feel they dealt adequately with your problem?

Family/household composition

57. How many separate (households) (families) live (at this address) (here)?

58. How many people live(at this address) (here)?

	Relationship	Sex	Age last birthday
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

59. Is there anyone who usually lives here who is now in a hospital or home, or away temporarily for some other reason? If yes, include above.

Housing/

Housing

60. Type of dwelling. House/flat/caravan/other.

61. Is it rented unfurnished/rented furnished/your own?

62. Who do you pay rent to?

a) District Council

b) Scottish Special Housing Association

c) Private landlord

d) Rent free.

63. Do you have the use of:-

	exclusive use	shared use	no use
a) fixed bath or shower with hot water supply			
b) inside flush toilet			
c) central heating			
d) telephone			

64. What rooms do you have use of?

a) bathroom

b) kitchen (under 6' wide/over 6' wide)

c) others 1.

2.

3.

4.

5.

6.

7.

8.

65. Are any of these let or sublet (specify)?

Economic level

66. Before anything is taken off, such as tax, superannuation, National Insurance, etc., what is (your total family annual income) (the total amount of money you and your family taken in each week)? By total amount I mean (wages) (salaries), social security, pensions, family allowances, and other income such as interest in the Post Office, Bank or elsewhere, or rent from property.

Time now:

---

67. Now I'd like to ask you about some ex-Nellie miners I'm still trying to trace. I wonder if you know where they are or what has happened to them?

Time left premises:

Comments:

Appendix 2: Extract from Scottish Miner, No. 241, October 1977.

Doctor to check Nellie miners

Accidents, pneumoconiosis, bronchitis, rheumatism, the beat diseases - these are some of the illnesses that miners and their families have come to know and live with ever since the early days of coalmining.

But even if we knew everything there was to know about all the complaints that miners suffer from, we would still need to answer a lot of questions before we had a complete picture of the health of coalmining.

What, for example, do the health services do for miners who already have these diseases?

Are miners and their families being provided with the sort of health services they need and want?

These are some of the questions that Dr. Ian Jones, who is working with Fife Area Health Board, is trying to find answers to in the next few months by studying the health of miners in the Lochgelly area of Fife.

He is looking at the men who were working at the Nellie pit back in 1956 before it closed down, and hopes to find out what has happened to them since then, and what their health is like today.

If you were a miner at the Nellie 20 years ago, you could be asked to help build up an overall picture of the health of coalmining by discussing with Dr. Jones the answers to these and other questions if he contacts you in the months ahead.

Appendix 3: Extract From Central Fife Times, No. 227, 29/12/77.

Health survey of miners and former miners

Under the auspices of Fife Health Board, a health survey of miners and former miners is to be undertaken by Dr. Ian G. Jones, Fellow in Community Medicine, over the next few months.

Dr. Jones told our reporter this week:

"We know a great deal about the health hazards of coalmining, but surprisingly, we know much less about what happens to miners with ill-health after they retire or leave the industry.

"Through the good offices of Mr. Jim Hunter of Lochgelly, I have a list of all the men who worked at the Nellie Pit back in 1955, and over the next two months hope to visit a selection of those working, retired or ex-miners still living in Fife to find out the state of their health now, and what the health services are doing for them.

"The overall results of this study will, I am sure, be of interest to all miners and their families in the area, although, of course, the information provided by each person will be treated in the strictest confidence.

"I shall write to each miner or ex-miner concerned individually before I approach him, but I thought it might be of general interest to your readers to know that a study of this kind is under way."

Appendix 4: Letter Posted To All Ex-Nellie Coalworkers Selected For Interview.

Fife Health Board

Your ref :
Our ref :
If calling ask for: Dr Jones
Date :

3 East Port
Dunfermline
Tel.: 23421
XExxxx36

Dear

You may have seen recently in the 'Scottish Miner' or in the 'Central Fife Times' that I am interested in finding out more about the health of miners and ex-miners.

Although we know a lot about the diseases miners get, we do not know much about what happens to miners once they become ill, or after they retire or leave the pits.

With the help of Mr Jim Hunter, former N.U.M. delegate at the Nellie pit, Lochgelly, I am trying to get in touch with some of the ex-Nellie miners to find out what their health is like now, and what the health services are doing for them.

I believe you were once a miner at the Nellie. In the next week or so, I hope to visit you at your home, and learn from you at first hand what your health has been like since you stopped working there.

Of course, any information you give me will be treated in the strictest confidence, but the overall findings will be interesting to all miners, ex-miners and their families.

If you wish me to call on any particular day or at any particular time of the day or evening, please phone to let me know.

Yours sincerely,

Dr Ian G. Jones

Appendix 5: Voluntary Organisations Registered with VORAG and Involved in Health Care in Fife Region.

THE ABBEYFIELD SOCIETY - Has four homes for the elderly in Fife, in Dunfermline, Kirkcaldy, Leven and St. Andrews.

ST. NINIAN'S SCHOOL & HOME FOR BOYS - In Falkland. Undertakes some remedial teaching.

THE ROWNTREE MEMORIAL TRUST - FAMILY FUND - Has a Social Worker in Fife. The Trust gives financial grants to purchase equipment or in other ways to relieve to stress of families who have a severely handicapped child.

ST. ANDREWS LIFE GROUP - Promotes to save the unborn child and also gives practical help to women and girls who might otherwise be tempted to seek abortions.

THE FIFE TOY LIBRARY GROUP - Runs toy libraries for handicapped children (both mentally and physically) from birth to 16 years. There is a rota of professionals, e.g. physiotherapists, occupational therapists, teachers, who help a family choose a toy which will assist with the particular disability from which a child suffers.

THE NATIONAL SOCIETY FOR CANCER RELIEF - Provides special grants for cancer sufferers towards nursing and convalescent home fees and day and night nursing in the home.

THE BRITISH RED CROSS SOCIETY - Visits hospitals and homes, has book libraries, paper and magazine distribution, assist at blood withdrawal sessions, etc.

THE ST. ANDREW'S AMBULANCE ASSOCIATION - Gives assistance to any person who is injured or has been taken ill until the arrival of medical aid and assists at public events needing First Aid coverage.

THE ST. JOHN ASSOCIATION OF SCOTLAND - Provides all forms of service to the sick and elderly. In Fife they are mostly concerned with the elderly and have a flat at Leven for providing holiday accommodation for the elderly.

THE SCOTTISH PRE-SCHOOL PLAYGROUPS ASSOCIATION - Has a "Play in Hospital" scheme.

THE SCOTTISH SOCIETY FOR THE MENTALLY HANDICAPPED - Has three branches in Fife which each run a Club for the mentally handicapped.

THE FIFE SOCIETY FOR THE BLIND - Exists for the welfare and teaching of the blind. This includes teaching of Braille and Moon, a talking newspaper in the Dunfermline area, free maintenance of radios, etc.

cont.

THE EDINBURGH & EAST OF SCOTLAND SOCIETY FOR THE DEAF - Has a Fife HQ in Kirkcaldy. Social and recreational activities are organised.

THE MULTIPLE SCLEROSIS SOCIETY - Aims to co-operate with the medical profession to ameliorate the suffering from MS and to provide holiday and welfare facilities for sufferers.

PHAB in Fife - Exists to encourage the provision of opportunities for physically handicapped and able-bodied young people to share interests and experiences. There is a course at Inverkeithing School each summer, and a number of clubs exist in Fife.

THE SCOTTISH COUNCIL FOR SPASTICS - Has a mobile therapy unit in Kilbarchan, Renfrewshire which is available on a home visiting service throughout Scotland. Activities for Fife Spastics are undertaken by the Fife Association for Spastics.

SPINA BIFIDA PARENTS GROUPS - Provide social and fund-raising activities.

THE WOMEN'S ROYAL VOLUNTARY SERVICE - Provides canteen and library services, etc. in hospital and works for the handicapped.

Appendix 6: Voluntary Bodies Represented on Local Health Councils in Fife.

West Fife Local Health Council

British Red Cross Society
Women's Royal Voluntary Service
Presbytery of Dunfermline
Age Concern Scotland
Scottish Council for Autistic Children
Co-operative Union Ltd.
Telephone Samaritans
Dunfermline's Citizen Advice Bureau
Soroptomist Club of Dunfermline

East Fife Local Health Council

British Red Cross Society
Women's Royal Voluntary Service
Presbytery of Kirkcaldy
Age Concern Scotland
Scottish Council for Autistic Children
Co-operative Union Ltd.
Blood Transfusion Service
Scottish Women's Rural Institute
Rotary Club of Kirkcaldy

North East Fife Local Health Council

British Red Cross Society
Presbytery of Cupar
Age Concern Scotland
Scottish Council for Autistic Children
Scottish Women's Rural Institute
Family Planning Association
Cupar and District Mental Health Association
League of Friends of Stratheden Hospital

Appendix 7: Multiple Decrement Table For Cohort of Nellie Coalworkers.

x	b_x	e_x	w_x	θ_x	x	b_x	e_x	w_x	θ_x
15	16	0	0	0	25	8	0	1	0
16	10	0	0	0	26	7	0	0	0
17	15	0	0	1	27	11	0	0	0
18	11	0	0	0	28	15	0	0	0
19	5	0	0	0	29	11	0	0	0
20	6	0	0	0	30	8	0	1	0
21	6	0	0	0	31	16	0	0	1
22	14	0	0	0	32	13	0	0	0
23	9	0	0	0	33	12	0	0	0
24	8	0	0	0	34	7	0	0	0
	100	0	0	1		108	0	2	1

x	b_x	e_x	w_x	θ_x	x	b_x	e_x	w_x	θ_x
35	10	0	0	0	45	10	7	2	1
36	8	0	1	1	46	7	5	2	2
37	9	10	5	0	47	4	5	2	0
38	7	8	3	0	48	11	6	2	1
39	7	10	4	0	49	8	9	2	2
40	10	8	3	0	50	13	10	4	1
41	11	4	0	0	51	7	6	3	2
42	8	4	3	1	52	11	5	2	3
43	6	5	1	0	53	4	13	4	4
44	7	9	2	1	54	4	8	1	3
	83	58	22	3		79	74	24	19

x	b_x	e_x	w_x	θ_x	x	b_x	e_x	w_x	θ_x
55	4	10	1	0	65	3	3	1	6
56	4	4	1	4	66	3	5	1	3
57	3	9	1	2	67	3	5	0	3
58	4	5	2	1	68	0	6	0	3
59	7	6	0	3	69	2	3	0	7
60	3	6	1	3	70	3	8	0	1
61	1	6	0	7	71	2	1	0	5
62	3	9	0	5	72	3	6	0	1
63	4	5	3	2	73	0	6	0	2
64	3	3	0	3	74	1	5	0	2
	36	63	9	30		20	48	2	33

x	b_x	e_x	w_x	θ_x	x	b_x	e_x	w_x	θ_x
75	0	2	0	3	85	0	0	0	1
76	0	1	0	1	86	0	0	0	1
77	1	1	0	1	87	0	0	0	0
78	0	0	0	2	88	0	0	0	0
79	0	2	0	5	89	0	0	0	0
80	0	0	0	1	90	0	0	0	0
81	0	2	0	3	91	0	0	0	0
82	0	1	0	5	92	0	0	0	1
83	0	1	0	2	93	0	0	0	0
84	0	0	0	2	94	0	0	0	0
	1	10	0	25		0	0	0	3

Appendix 8: Central Exposed To Risk Population, E_x^c, For Cohort of Nellie Coalworkers.

$E_{15}^c = 8$	$E_{25}^c = 102.5$	$E_{35}^c = 208.5$
$E_{16}^c = 21$	$E_{26}^c = 109.5$	$E_{36}^c = 217$
$E_{17}^c = 33$	$E_{27}^c = 118.5$	$E_{37}^c = 217$
$E_{18}^c = 45.5$	$E_{28}^c = 131$	$E_{38}^c = 212$
$E_{19}^c = 53.5$	$E_{29}^c = 144$	$E_{39}^c = 206.5$
$E_{20}^c = 59$	$E_{30}^c = 153$	$E_{40}^c = 202.5$
$E_{21}^c = 65$	$E_{31}^c = 164$	$E_{41}^c = 205.5$
$E_{22}^c = 75$	$E_{32}^c = 178$	$E_{42}^c = 209$
$E_{23}^c = 86.5$	$E_{33}^c = 190.5$	$E_{43}^c = 209$
$E_{24}^c = 95$	$E_{34}^c = 200$	$E_{44}^c = 206.5$
$E_{45}^c = 204$	$E_{55}^c = 163$	$E_{65}^c = 96.5$
$E_{46}^c = 203$	$E_{56}^c = 157$	$E_{66}^c = 90$
$E_{47}^c = 200.5$	$E_{57}^c = 150$	$E_{67}^c = 84.5$
$E_{48}^c = 200$	$E_{58}^c = 143$	$E_{68}^c = 77.5$
$E_{49}^c = 198.5$	$E_{59}^c = 140$	$E_{69}^c = 69$
$E_{50}^c = 195.5$	$E_{60}^c = 135.5$	$E_{70}^c = 62$
$E_{51}^c = 192.5$	$E_{61}^c = 126$	$E_{71}^c = 57$
$E_{52}^c = 191$	$E_{62}^c = 114.5$	$E_{72}^c = 53$
$E_{53}^c = 183$	$E_{63}^c = 106$	$E_{73}^c = 47$
$E_{54}^c = 170.5$	$E_{64}^c = 101.5$	$E_{74}^c = 40$

E_{75}^c/

$E^c_{75} = 34.5$

$E^c_{76} = 31$

$E^c_{77} = 29.5$

$E^c_{78} = 28$

$E^c_{79} = 23.5$

$E^c_{80} = 19.5$

$E^c_{81} = 16.5$

$E^c_{82} = 11$

$E^c_{83} = 6.5$

$E^c_{84} = 4$

$E^c_{85} = 2.5$

$E^c_{86} = 1.5$

$E^c_{87} = 1.0$

$E^c_{88} = 1.0$

$E^c_{89} = 1.0$

$E^c_{90} = 1.0$

$E^c_{91} = 1.0$

$E^c_{92} = 0.5$

$E^c_{93} = 0$